POPULAR MECHANICS

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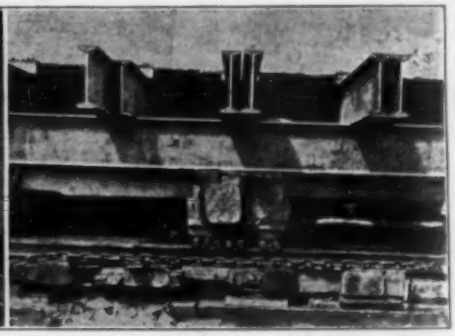
8,000-TON OPERA HOUSE MOVED

Big Six-Story Building Travels 300 Ft., Turning Half Way Round in its Journey

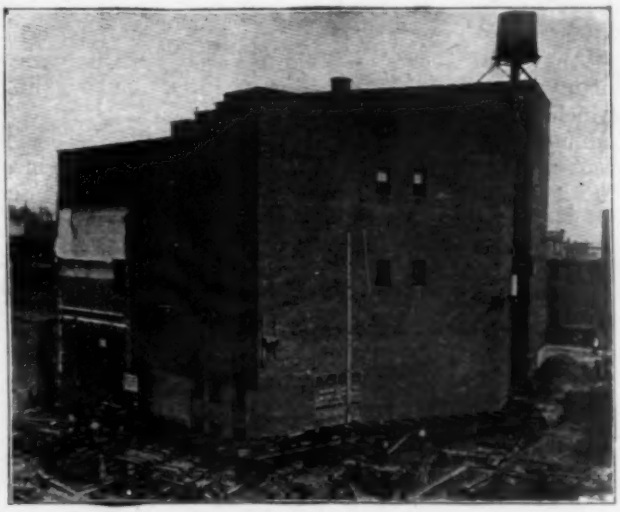
Working the Turn-Screws



Steel Beams and Rollers

For a distance of 300 ft., at a rate of 10 ft. each day, an 8,000-ton opera house building, approximately 6 stories in height, has been pushed along on its wearisome way to a new site, its titanic bulk unceremoniously kicked in the back by 25 powerful, hand worked turn-screws.

This great feat, considered the most gigantic of its kind ever undertaken, has just been accomplished in Brooklyn, after a little over six weeks of work. To move the big structure 1,600 screws for lifting, 1,600 steel rollers on which it moved, and 450 steel beams as temporary foundation were used. At a given signal 25 men, working in unison, turned the screws with crowbars. The structure is of brick and stone, 165 ft. long, 85 ft. wide and 95 ft. high. To rest the building squarely upon its new foundation it was necessary to turn it in a semi-circle. The moving of the building was necessitated because its site obstructed the line of a railway extension.



The Great Structure of Brick and Stone

ELEPHANTS SHOOT THE CHUTES

An elephant can be trained to do many surprising things, an instance of which is seen in the illustration. An animal naturally is fearful of any except what seems a secure support, and the larger the animal the more keenly this instinct seems to be developed.

Occasion was had not long since to lead a very large elephant across a wooden bridge which was getting old. Upon reaching the structure he stopped, tested it gently with one foot and gave a snort. No amount of urging had any effect. He simply would not cross. After exhausting all efforts the bridge was strengthened, after which he consented to use it.

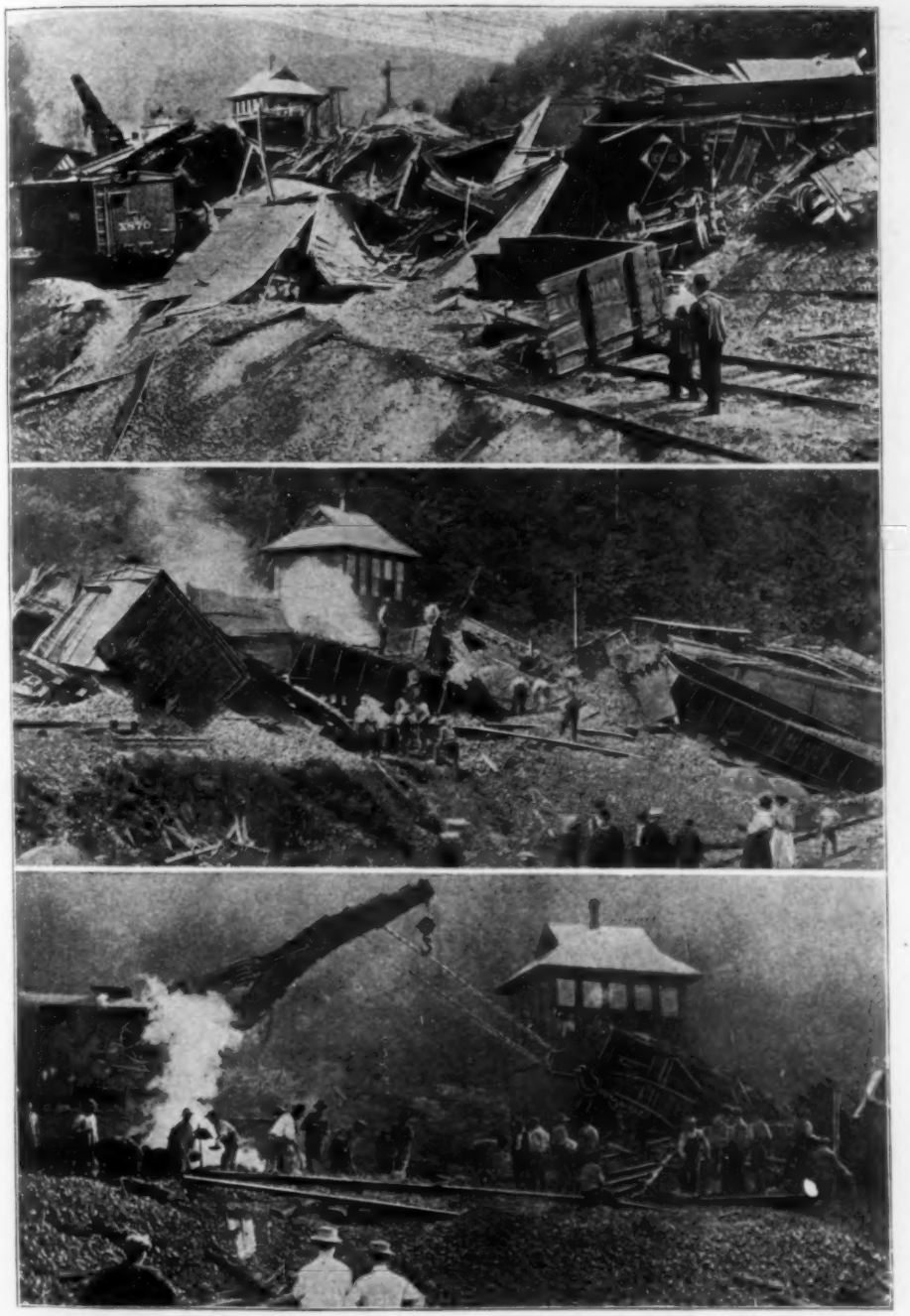
This natural cautiousness makes the training of a herd of elephants to shoot the chutes a really remarkable accomplishment. The exhibition may be seen at the Versailles exposition, and spectators claim the elephants actually appear to enjoy the sport.

August broke the 1907 shipping record of the lakes by the movement of 6,806,810 tons. This is at the rate of over 50,000,000 tons for a season of 8 months.

REMARKABLE RAILROAD WRECK

One of the largest and in many respects one of the most miraculous wrecks in the history of modern railroading occurred on the Erie railroad at Jefferson Junction, near Susquehanna, Pa., early on the morning of August 6, 1907. Nine miles up a heavy grade a train consisting of engine, 42 loaded cars and caboose, became unmanageable on account of the air brakes failing to work properly. Notwithstanding the fact that the engineer reversed the engine and did all in his power to stop the train, it rapidly gained headway until it was estimated that it reached the speed of 75 miles per hour when it struck the switches of the interlocking plant at the junction.

The engine passed over safely, but the first car jumped the track, and in the twinkling of an eye the 42 loaded cars and the caboose were a mass of wreckage as shown in the illustrations. The engineer and fireman escaped without a scratch and the engine was not badly injured, the greatest injury being to the tires, which were run off on account of the great heat generated from the friction of the heavy engine sliding for nine miles over the rails. The head brakeman was slightly cut and bruised from jumping, otherwise no one was injured. The operator and the tower were unhurt, although the wreckage was piled on every side and a small building near the tower was demolished. Car X870 was filled with sleeping Italians, none of whom were injured. Note how a broken rail near this car went completely through a box



Views Showing Wreck and Wrecking Crew at Work

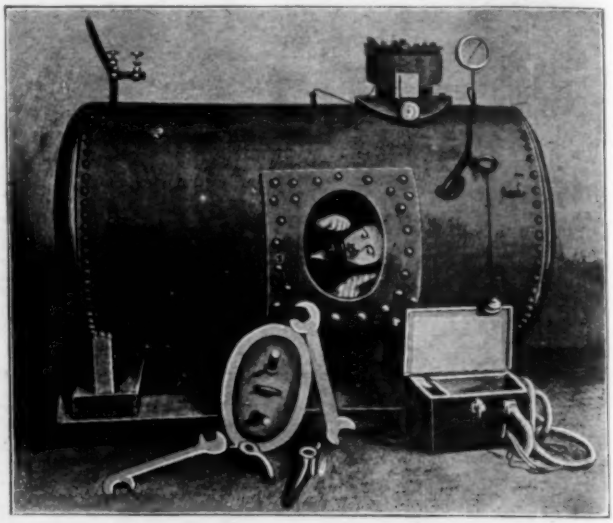
car and extended nearly 15 ft. into the air. The durability of the modern steel car seen at the left is also well illustrated in one of the pictures.

EXPERTS RISK LIVES IN COMPRESSED AIR EXPERIMENTS

Experiments in compressed air made by two English physicians, Leonard Hill and M. W. Greenwood, demonstrated that divers can descend at least 210 ft. under water and possibly 240 ft. without danger of death from the pressure.

For this experiment a specially constructed cylinder of steel was used. Bedding, coverlets and cushions were placed in the interior for comfort, and electric lights and a telephone installed. Besides a unique orifice for compression two loopholes were provided for de-compression, one showing at the left of the cut. A monometer registered the variations of pressure.

M. W. Greenwood was isolated in the cylinder 3 hours and 11 minutes. At the end of the first 15 minutes the pressure attained 17 lb. In 54 minutes the maximum pressure of 100 lb. was reached, gradually returning to the normal pressure at the end of 2 hours and 17 minutes. Air was forced into the cylinder by a pump capable of raising pressure to 6 atmospheres in 40 min



Cover Removed Showing Position of Surgeon

BIG BATTERY OF RAMS

The battery of 11 rams shown in the illustration are working at Sunnyside, Wash. The fall is 39 ft. and 5 cu. ft. per second are used with about 80 per cent efficiency, the discharge water being lifted 147 ft.

This Battery of 11 Rams Raises the Water 147 Ft.

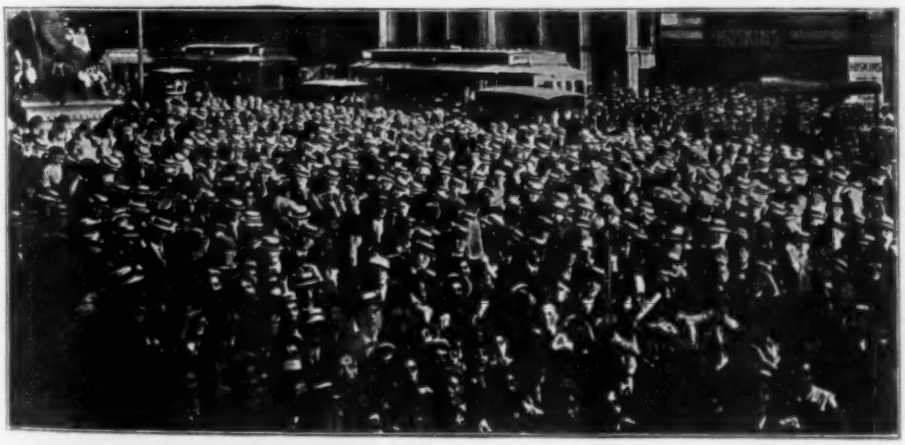
CHAMPIONS PLAY BALL GAME IN BUSY CITY STREET

Electric Reproduction of Actual Game Played Miles Away

A baseball signal board that is the nearest approach yet devised to a substitution for the actual game on the field has caught the town in which one of the near winners of the pennant is playing. Daily in Philadelphia one of the leading thoroughfares is blocked by a yelling crowd that gathers outside the building in which one of the newspapers is housed. The board is so arranged that every play on the field can be seen at a glance. Electric bulbs are lighted to show the position of the batter, the state of the game and the manner of the play recorded.

When the pitcher has the ball ready for play a light in the pitcher's box glows out. If a strike results from the throw another light shows that the batter has connected with the ball. If he reaches his base, the light at that point shows he is safe. If he is thrown out on the way to first base, another light reveals that to the crowd. If he fails to hit the ball, a light in the catcher's box shows that the man behind the bat has

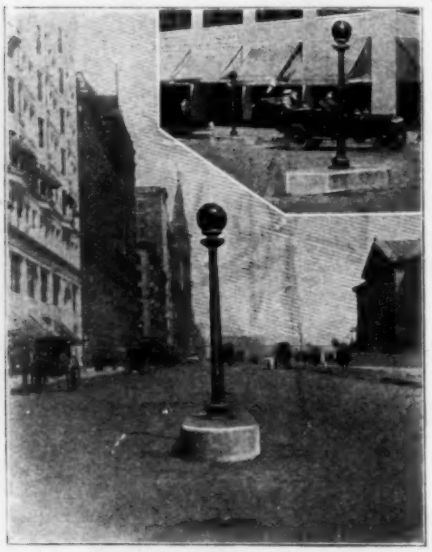
All the Details of the Game Are Shown as Fast as They Occur



the sphere. If a ball is called by the umpire, a light in the department marked "balls" shows that point in an instant. The batters are numbered opposite their names on a big board below the board proper and the light opposite that number shows who is at the bat. It is by far the most ingenious and simple contrivance for enabling spectators who are unable to see the original game to follow its fortunes at a glance while far away that has ever been devised.

OBSTRUCTING SPEED MANIACS

Wild, reckless driving of automobiles around corners, by speed maniacs, has



Danger Sign in Street

been effectively stopped in Chicago by the erection of danger lights and substantial obstructions (really to protect the light) in the center of the pavement at all intersecting boulevards.

The light, announcing danger through a red globe, is supported on a cast-iron pedestal 14 ft. high. This in turn is supported and "protected" (great emphasis on the protected) by a solid concrete base, 2½ ft. by 5 ft. and rising 1½ ft. above the pavement. Two lights and obstructions are placed at each intersection.

When the autoist approaches at a rapid clip he sees the gleaming light. He slows up to three or four miles an hour because if he does not he is liable to smash into the concrete obstacle and destroy the light, which action is frowned upon by the municipality, to say nothing of what would happen to the automobile.

POWDER FLASH CURES SNAKE-BITE

While crossing the arid deserts of Nevada some years ago, before Milwaukee's fame had become great enough to keep him home, a now permanent resident of the brewery city, was bitten by a rattle snake and gave up all hope. The guide threw him to the ground, and breaking open a cartridge covered the wound with powder. The powder was touched off, cauterizing the wound effectively. The next morning nothing more serious than a stiff leg resulted.

PROTECTIVE GLOVE FOR X-RAY OPERATORS

The protection of physicians operating the X-rays has become far more important than the protection of patients, the danger to the former being much greater owing to continued exposure to the radiation in treating many cases.

Many methods for protection of the parts of the body radiated upon are now being used, a number of which are effective when great care and attention is shown by the operator. The latest of these protective appliances is a glove consisting of an elastic protective substance.

DUMP WAGON FOR BRICKS

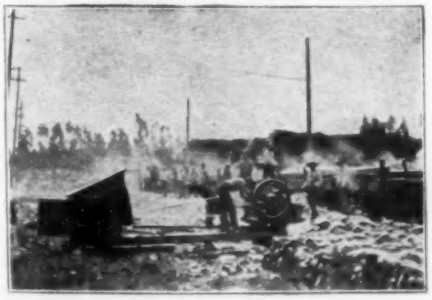
The special dump wagon shown is for hauling and unloading brick. The front wheels carry as much load as the rear wheels, the capacity of the two

Unloads in a Moment

boxes being 1,200 brick. The drop is so small the bricks are not broken when the wagon empties.

PORTABLE ELECTRIC ROCK CRUSHER

An electric railway desiring to ballast its tracks with crushed stone in a district where plenty of rock was to be had along the route, rigged a portable crusher. The machine was mounted on a skid and driven with a belt from an old street car motor. Power was secured from the overhead trolley wire. As fast as enough rock was crushed in one place the outfit was moved along.

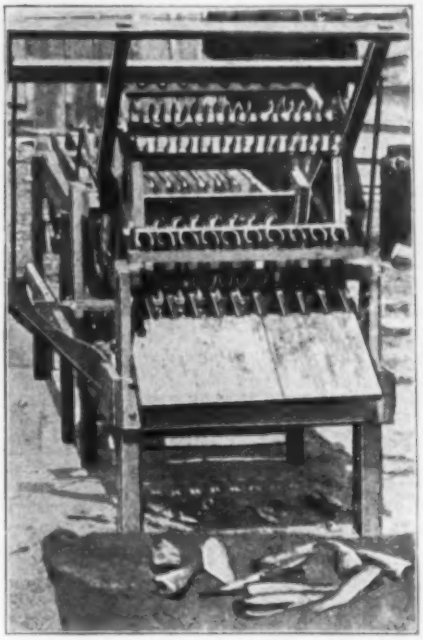


The Electric Crusher

DRESSING FISH BY MACHINERY

The difficult problem of dressing fish by machinery, to save the enormous amount of hand labor necessary at canneries, seems to have been solved at last by the invention of a Pennsylvania man, who has devised a machine which scrapes off the scales, cleans the fish and trims off the heads, tails and fins.

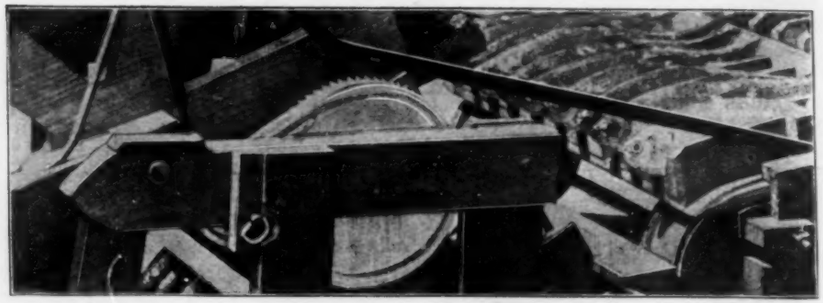
The fresh caught fish are fed into the machine from a table, dropping



Machine Turning Out Dressed Fish

into pockets, which are arranged in sets of ten on an endless belt, the sets so arranged that as one set is filled and moved away another set moves forward to be filled from the table. By the movement of a controlling handle the fish are tightly clamped into the pockets and are brought against a set of knives. These enter back of the gills and pass upward almost through the fish, then turn downward and backward toward the tail, leaving the intestinal cavities open.

With the onward movement the fish come in contact with devices which



Fish Passing Through Machine—300 Per Minute

thoroughly scrape them out, while other knives remove the fins and scales and still others clip off the heads and tails.

The idea for his fish cleaning machine came to the inventor as he stood by the banks of the Chowin river, in Virginia, and watched the comparatively slow work that was being done by the employes of a large fishery in preparing their catch for salting. He claims the machine will completely dress from 200 to 300 fish a minute, depending upon the size.

MAGNETIC PROPERTIES OF STEEL SHIPS

The magnetic character of vessels has been given a comprehensive demonstration at Bremen, Germany. The first observation, taken 10 weeks after the double bottom of a ship had been placed and riveted, showed the polaric power of the vessel to be 25 per cent. A month later the induction had advanced to 34 per cent, and so on until just before launching, a magnetic power of 57 per cent of the horizontal magnetic power of the earth was reached.

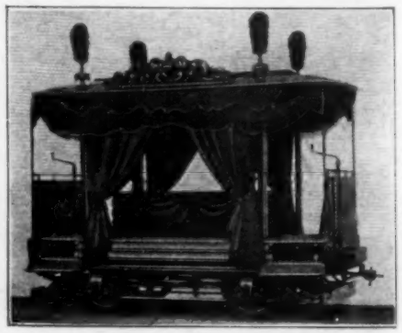
When launched the boat was swung into a position nearly opposite to that in which it was built with the result that in a period of 20 days the magnetic power had decreased to 15 per cent. As a consequence the standard compass on the flying bridge went to sea without a compensating magnet, and the steering compass with only one.

A sister ship after launching was not swung and her head pointed in the same direction during completion as when building. The result was an increase in the magnetic power to 68 per cent of the earth's power, consequently seven compensating magnets were required to counteract the effect and make the compass point correctly.

FUNERAL CARS IN BRAZIL

Funeral cars of a peculiar design, resembling more a hearse than cars used for the same purpose in this country, are now being used in Bahia, Brazil. The funeral car runs on a track which ends at the cemetery gate. The funeral cortege follows the car bearing the coffin, in other cars of almost the same design, provided with from two to four seats.

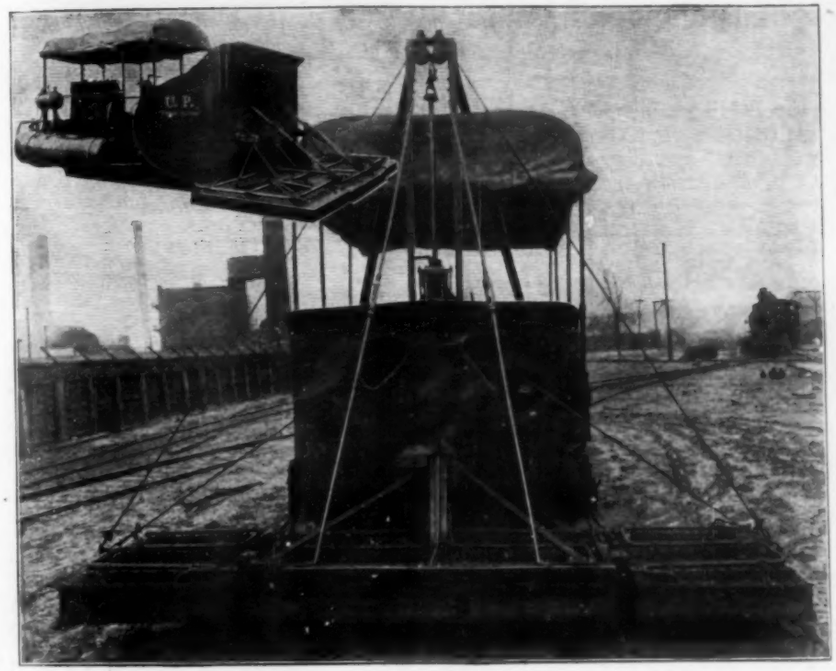
This South American city is separated into two parts, the cemetery lying back of the resident portion on a bluff 140 ft. above the rest of the city.



Street Car Hearse

MAMMOTH GASOLINE WEED BURNER

Thirteen-Ton Machine Does the Work of 300 Men



Burns 4 Miles of Track an Hour

Thousands of men, at a cost to the railroads of hundreds of thousands of dollars, spend the entire summer in a battle with weeds. The main lines, ballasted with gravel, cause less trouble, but along the miles upon miles of branch lines and sidings weeds of every description grow to a height of from 2 to 7 and even 8 ft. Sixteen men, with scythes and hoes by hard work are able to clean up one mile of single track in a day. Notwithstanding the great expense, the weeds must be kept down.

The superintendent of motive power of the Union Pacific railway, W. R. McKeen, has invented a gigantic weed burner weighing 13 tons which moves over the track at 4 miles an hour, bearing a hurricane of flame. When its day's work is done it has accomplished as much as 300 men would have done.

The car is propelled by gas motors, and burns 25 miles of track per day. Gasoline is forced through the burners with compressed air, making an intense heat, which is deflected downward. A strip 12 ft. wide, extending 3½ ft. on either side of the track, is burned over at a cost of $5.74 per mile, against $22.40 for hand labor. The approved system is to give the first burning when the growth is 6 or 8 in. high, and after it has dried a few days repeat the treatment, which consumes the weeds and kills the roots. When the burners are not in use the car travels at 16 miles an hour, and at

all times its movements are under orders of the train dispatcher, the same as any train.

PROPER WAY TO HAND TELEPHONE INSTRUMENT TO ANOTHER

In holding a telephone a person naturally takes the transmitter in the right hand and places the receiver to the left ear with the other. In passing the instrument to another person the hands should be crossed as shown in the cut, thus extending the transmitter and receiver to the right and left hands, respectively, and obviating the inconvenience and possible breakage occasioned by the other person's attempt to change from both hands at the same time.

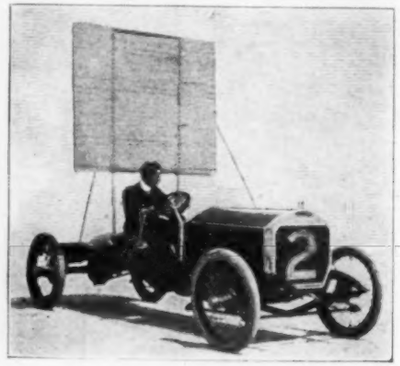
MOVABLE SAND ELEVATOR

This sand elevator is mounted on four wheels which run on temporary track built along a Rocky Mountain stream. As fast as the available sand is used the elevator is moved to another place.

Sand Elevator on Wheels

HIGH SEATS IMPEDE AUTO

Experiments with wind resistance to determine to what extent the speed of automobiles is retarded by high backed rear seats and limousines are being made in England. A standard car with light two-seater attached was found capable of making 50 miles an hour. A heavy side-entrance phaeton attachment, with hood, brought the speed of the same car down to 35 miles an hour. In many instances a variance of from 5 to 20 miles in speed capacity was shown, according to the resistance of the different attachments. A shallower, but just as comfortable,

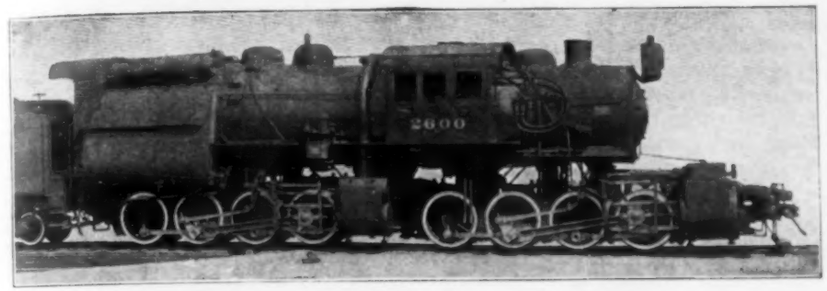


Determining Wind Resistance

rear seat will in many instances make a difference of from 5 to 10 miles in speed. The illustration shows an arrangement, one of many sizes, by which the resistance can be judged.

ARTIFICIAL SUNLIGHT FOR PLANTS

A series of experiments, which if successful will revolutionize the production of fruit and flowers under glass, and enable the gardener to obtain both in a much shorter time, have just been begun in the Royal Botanic Gardens in London, Eng. A powerful arc light, surrounded with water so that the rays may resemble those of the sun, diffuses light over the plants directly the solar light fails.



The greatest locomotive ever built is now completed, and as the picture shows, is anything but attractive. It is a monster, however, and with the tender is nearly 100 ft long. It weighs 205 tons, all of which is carried on the 16 drivers. The 404 boiler tubes weigh 23,700 lb.; the water in the boiler weighs 42,700 lb., and boiler and contents, 139,000 lb. The engine is a compound of four high and four low pressure cylinders and is used as a pusher for freight trains on the heavy grades of the Erie road.
The engine is too powerful to pull a train and will be used exclusively as a pusher.

TROUBLE OF REPAIRING OLD PIANOS GREAT

A long wail of complaint comes from piano manufacturing concerns owing to the time wasted by their workmen in tinkering up old pianos and organs sent by dealers to the factories to be re-constructed. Almost impossible feats of workmanship are at times demanded and in the end owners pay more for repairs on such instruments than they are worth.

In one instance a piano was sent to a firm with a demand that it be returned good as new and with a new tone, after being stored in the barns of an express company during a severe winter. Exposed to moisture-laden air and below-zero weather, the bass strings have rusted until "dead." It costs more to re-wire an old piano than to wire a new one.

NAUTICAL RULES FOR AUTOS

A bill is to be introduced in the British parliament, applying to automobile traffic the legal obligations now imposed upon shipping, and when a collision occurs the task of proving innocence will rest upon the shoulders of the navigator of the swifter and more easily controlled automobile. The bill also confers power to suspend the licenses of the negligent navigators of the road as is done on the sea.

SANITARY GARBAGE WAGON ELIMINATES ODORS

A sanitary garbage wagon is being used in Berlin and Paris which reduces to a minimum the flying of germ polluted refuse and the odors which especially arise during warm weather

Chute Prevents Escape of Odor

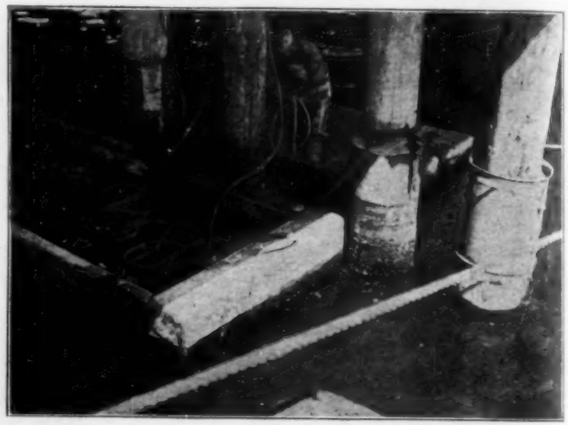
from garbage carried through the streets in the inadequate wagons usually used.

This wagon is completely covered by a large hood of sheet metal, with a sort of chute or funnel, which elon-

gated upon the roof of the hood curves downward at the back end where it is open to receive the refuse. The garbage is placed upon a movable platform under the mouth of the chute and raised by chains into the interior. A trap door opens by the turning of a lever and the box diverts its contents into body of wagon, odor and all.

PROTECTING PILING WITH CEMENT

On the Pacific coast where it is necessary to protect under water piling from the ravages of sea insects the most satisfactory method has been found to cover with cement. To do this sheet iron molds made in two pieces are used, held together by a wedge-shaped clamp; screw clamps would rust. In the illustration the diver is down about 25 ft. He first places the metal molds in position. Having done this he signals to the man shown in the scow to lower a metal bucket filled with concrete. The diver pours the filling into the mold and tamps it firmly. As fast as one section is filled another section of mold is added above the first, and the process continued until the casing is above high tide. After the cement has set the diver removes the molds for use again. This method makes a complete one-piece cement cylinder around the piling.



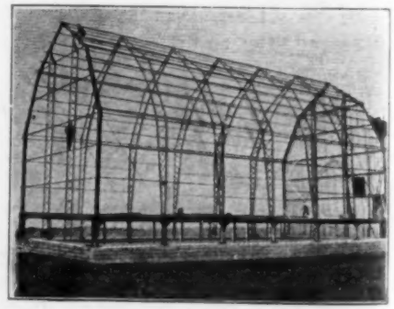
Lowering Cement to the Diver

ELECTRIC FANS RESTORE ASPHYXIATED PERSONS

Electric fans as an aid in reviving asphyxiated persons were found greatly beneficial at a recent disastrous fire in which a number of firemen were overcome by gases. Wires were run from offices near the scene of the fire and attached to fans placed close to the heads of the unconscious men. The rush of air forced into the faces of the men by the fans soon brought them back to consciousness and they returned to continue the fight against the flames.

STEEL BARN STRUCTURES

Steel, for the construction of barns is coming into general use in many parts of the country. The absence of beams and posts gives the entire space of the buildings for storage, and by a movable carrier track loads can be dropped at any place without forking or handling, requiring no help in the barn while unloading. Danger of fire is materially lessened. The rapid advance in the price of lumber makes these structures only a little more expensive than timber.



Steel Frames for Barns

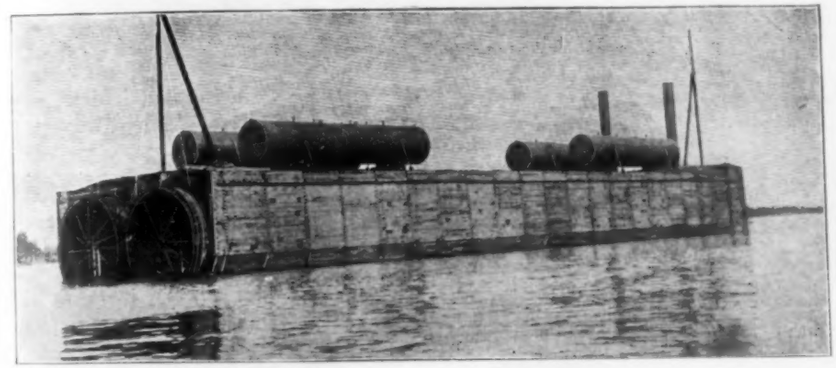
WATER TROUGH COSTS $250

After paying for several watering troughs in front of his store, which were smashed when heavily loaded wagons ran into them, the proprietor gave orders to build one which could not be broken. The illustration shows what he got, but it cost him $250. The trough is built of ¾-in. steel plate; at one end an iron box protects the water meter. On the street side three iron posts of 4-in. pipe support an apron of ½-in. boiler plate.

FLOATING MAMMOTH TUNNEL

Air Cylinders to Regulate Placing of Tubes—Disastrous Cave-In

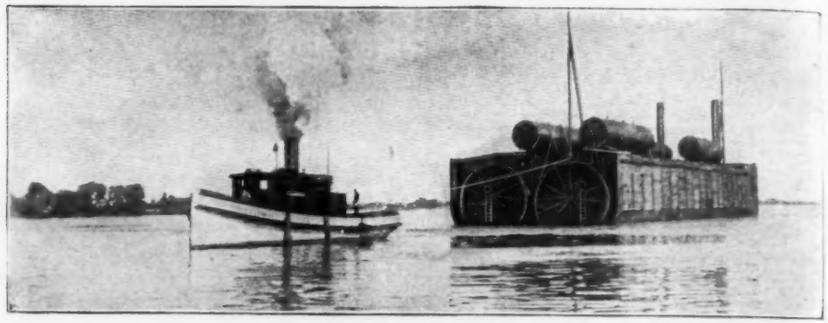
One of the twin-tube sections for the Michigan Central tunnel under the Detroit river at Detroit, the tubing of which is being constructed on shore, has been completed and launched traversely, floated down the St. Clair river and through Lake St. Clair to the trenches excavated at the bottom of the Detroit river.



Floating the 300-Ft. Section of Double Tunnel

Two steel cylinders, 60 ft. long and 10 ft. in diameter, secured by chains to the diaphragm, act as air chambers, so arranged that they can be easily adjusted in any position along the tubes. When the valves in the bulkheads of the tubes are opened to admit sufficient water to sink them beneath the surface, the upper cylinders, above mentioned and shown in the illustrations, are placed in the proper position to maintain the tubes on a horizontal plane as they are gradually submerged.

The cylinders are provided with a compressed air mechanism, and valves making possible their partial submersion or elevation, as the circumstances of the moment may demand. In this way the engineers have complete control of the entire structure, as the tunnel tubes cannot sink except as the buoyancy of the air chambers is overcome by the weight of water admitted.



The Floating Tunnels Were Towed by One Tug

Only one accident has so far marred the work. Shaft No. 1, was almost completely wrecked and a dozen workmen narrowly escaped being buried beneath tons of debris as the result of a disastrous cave-in a few weeks ago, caused by the tremendous pressure of the embankment above. A wall 40 ft. below the surface collapsed like paper and the tunnel cut proper, a drift 8 ft. by 15 ft., was filled for 50 ft. from the shaft island.

As a result of recent accidents to various navies the British warships will have their magazines cooled with refrigerating machinery.

WIRELESS 'PHONES FOR ATLANTIC SQUADRON

Through a wireless telephone system being installed on the ships of the Atlantic Squadron, Admiral (Fighting Bob) Evans will be able to talk with the officers of his battleships five miles apart. This, too, without shocking the ears of telephone girls when a hot engagement is progressing.

Details of the invention are kept secret by the department because of an unwillingness to inform foreign powers of their nature. The "Louisiana" and "Virginia" have been thus equipped for some time with satisfactory results.

Tunnel Cave-In at Shaft No. 1

UNIQUE FEAT IN BRIDGE BUILDING

In order to give necessary space for the construction of a new bascule bridge across the north branch of the Chicago river immediately alongside the old swing bridge, and yet allow the old bridge to be swung for the passage of boats, is the problem which confronted and was successfully solved by the engineers of the Chicago & Northwestern railroad.

To make this problem possible a portion of the east arm of the swing bridge was cut away and a temporary trestle built to take its place. One hundred and sixty-five tons of pig iron, placed in strong wooden boxes, securely bolted together and supported on transverse struts resting on the top chords, were used as a counterweight for the west arm, left intact. The counterweight required was accurately calculated by an arrangement of electric contact points on the extreme west end, so that, at the first tendency of the counterweight to lift this end, the contact was broken and a signal given by an electric bell.

The work was commenced and completed on a Sunday, traffic being the least heavy on that day. At 9:40 a. m. the last train passed over the bridge and a gang of 150 mechanics commenced work. At 5:30, after a blockade of only 8 hours, work was completed and traffic resumed.

AUTOMOBILE SCISSORS GRINDER

These are certainly progressive times when the formerly humble occupation of scissors grinder is raised to the dignity of automobilist.

An Aristocrat

An enterprising citizen of Los Angeles who conceived the idea of covering the entire city every day by

Nearly Half This Bridge Was Cut Off

means of an auto, bought a machine and rigged up connection for driving his grinding wheels with power from the engine. His regular customers include butcher shops and restaurants, which are served at the same hour each day; in the afternoon he visits the residence streets. The time formerly spent in walking from place to place is now profitably employed in actual money earning work. His expense for gasoline is about 25 cents a day.

BRACE FOR CONCRETE BRIDGE

This concrete bridge is a failure partly because the arch was too flat and on account of the jar of the heavy trains

Arch That Failed

which pass under it. The bridge was made of what was considered good material and reinforced with iron, but cracked badly in three places. It was necessary to brace it strongly with supports in order to permit wagons to cross.

BREAKING POINT OF TOW-LINES

The problem of just where the greatest strain occurs on a tow-line has been determined as follows, and although no special experiments have been made, it is borne out by the fact that a line invariably breaks close to the point of contact.

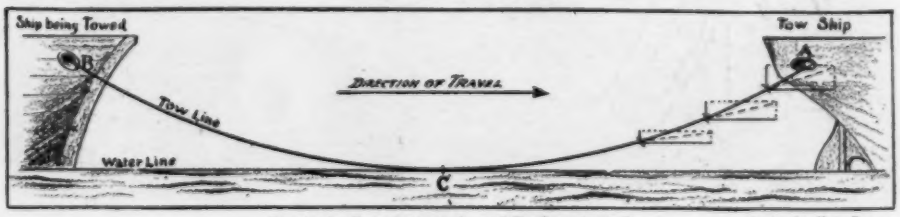
In a curve made by a tow-line, called a "catenary," the horizontal components of force acting along the entire length of the rope are equal, while the vertical exponents of force, due to the weight of the rope, gradually diminish where the rope sags the lowest. The direct causes of a break are stress due to the pull of the towing vessel and the resistance of the ship being towed; stress due to the weight of the rope, and stress due to swaying and vibration.

When the tow-line is attached at the same height to both vessels the greatest stress occurs close to this point on each. Otherwise the stress caused by the vibration and swaying of the rope, acting at the center in conjunction with the stress due to the pull, will cause the rope to part close to that point of attachment which is the higher of the two.

TIDES AT TERMINI PANAMA CANAL

It is interesting to note the difference in the tides of the two oceans at the termini of the Panama Canal. The mean level is the same, but on the Atlantic side the tidal oscillation does not exceed 2 ft., whereas on the Pacific side it is at times as great as 20 ft.; 10 ft. above and 10 ft. below the mean level.

The public schools of Cleveland may be equipped with book holders, which enable the scholars to sit erect while studying.

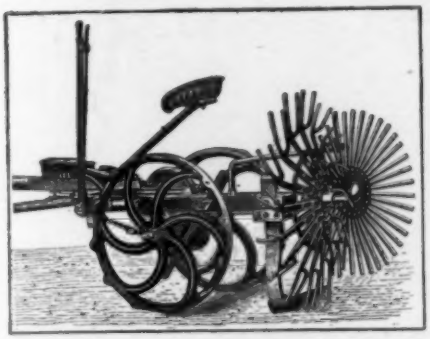


Strain is Greatest at A and B—Least at C

Courtesy Am. Marine Engineer

POTATO DIGGING MACHINE

This queer looking machine is made in England for use in New Zealand. It is drawn by two horses, the driver rides, and the potatoes are dug and thrown out to one side on the ground.



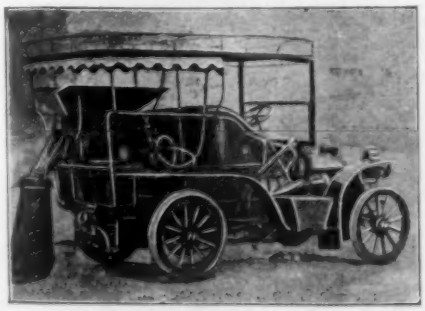
Potato Digger

There are American made machines, however, which not only dig, but shake the dirt from the potatoes, elevate them and drop them into sacks.

AUTOMOBILE MILLING AUXILIARY

An automobile is now being used in England in demonstrating to country millers the process of bleaching. The bleaching machinery, consisting of a generator and agitator, is mounted in the space usually occupied by the tonneau and is operated by the motor which drives the car. An expert representative of the milling company, accompanied by a chauffeur, takes the outfit all through the country side visiting the many milling establishments. The machinery is capable of treating nearly 3 bbl. an hour.

"The venture met with so much success," says The American Miller, "that two similar cars have been ordered. The first car used is now touring France and the two new cars will be used in Great Britain and on the continent."



Traveling Millers' School

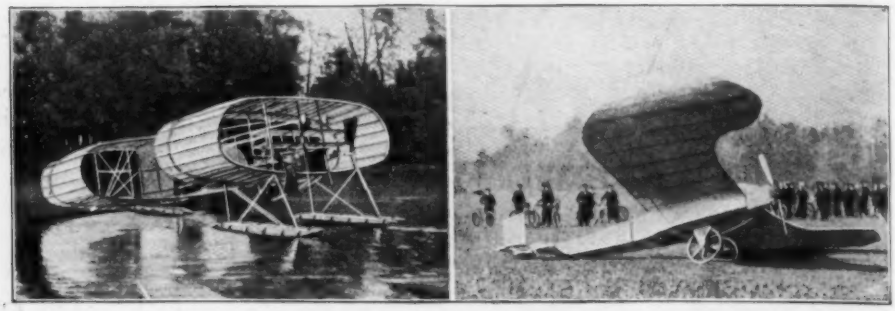
WATCH TICKS IN A CAKE OF ICE

A watch, frozen into a cake of ice for 48 hours, during which time it recorded accurately the fleeting seconds and minutes, is one of the latest wrinkles in jewelry advertising. In referring to the uniqueness of the advertisement Ice and Refrigeration says that the movement of the watch was first incased in a watertight casing and placed in a hole in the cake of ice just large enough to contain the time piece. A piece of mica was then placed back of the watch and water, at a freezing temperature, poured slowly into the hole until it was completely frozen up.

Show Window Novelty

The 50-lb. cake of ice was placed in a show window where the attention of passing pedestrians would be attracted. Around the watch, but further in the rear, flowers and ferns were frozen into the ice in the same manner, making a beautiful floral frieze.

UNIQUE FRENCH AEROPLANES



M. Bleriot's Latest Aeroplanes

Two unique airships of the aeroplane type have been constructed by a French inventor, M. Bleriot, and tried with more or less success. The first is a cellular aeroplane of which the cells are elliptical. This machine is propelled by light motors of 24 hp. and has been tried a number of times on Lake Engheim. Flight is always commenced from the water.

Another of this inventor's constructions is an aeroplane of the monoplane species, having the form of a bird without a tail, but with a long neck at the end of which the helm is carried. It is believed that this neck, or prow, which carries the aeroplane upright, will prove unstable and trials are soon to be made with the idea of equipping it with a tail.

GIANT WRECKING STEAMER

Carries Complete Machine Shop and Expert Marine Workers

The steel wrecking steamer "Favorite" has just been put in service in the Straits of Mackinaw. She is owned by the Great Lakes Towing Company and is said to be the most completely equipped wrecker afloat, either on fresh or salt water. The vessel is 196 ft. long and 43 ft. wide. When lying at her dock steam is constantly kept up, ready to leave on a moment's notice; long-distance telephone lines are run into the captain's cabin. Every man on board is an expert in his line, and among them can be found one or more competent to make any repair to a vessel that may be needed—divers, electricians, ship's carpenters, machinists and men skilled in removing every kind of cargo in the shortest possible time.

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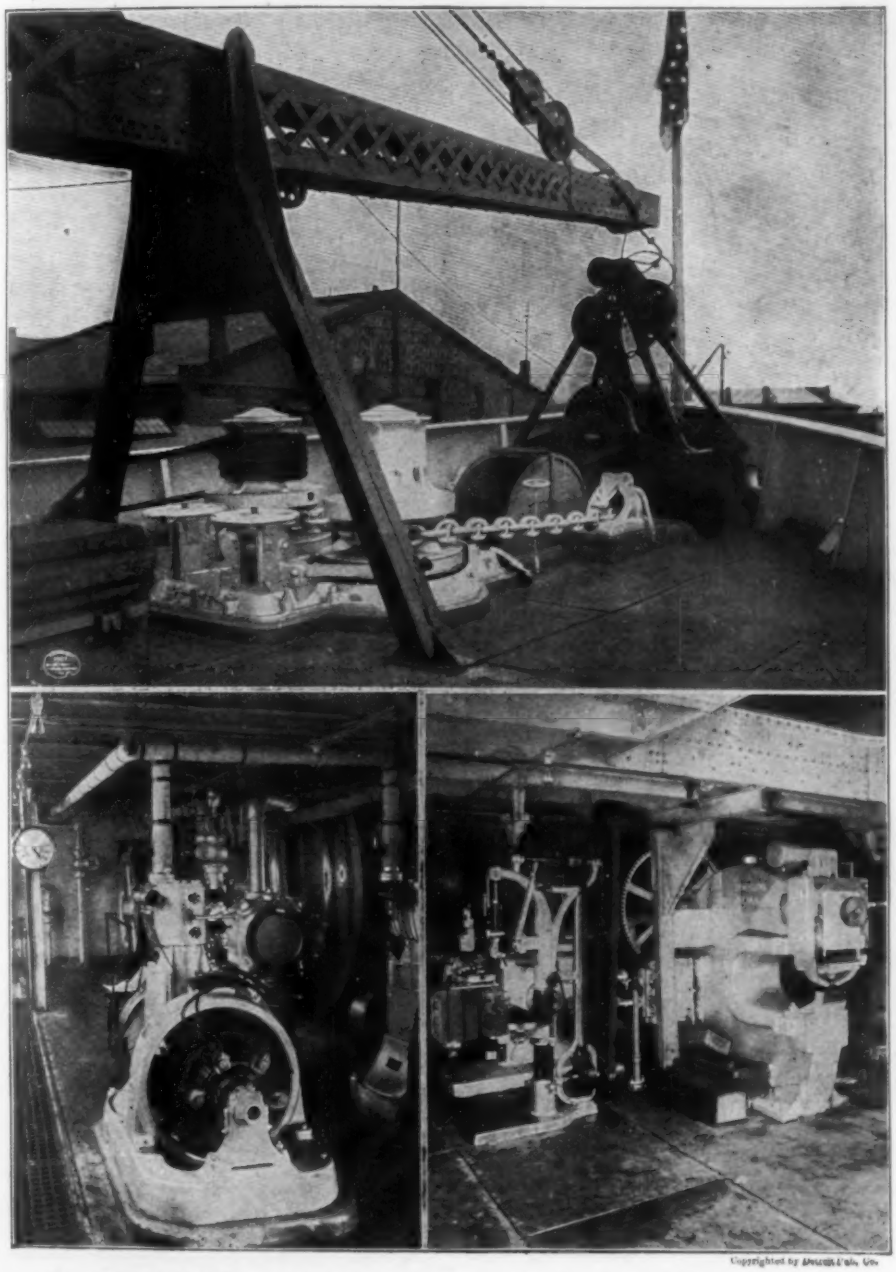
Steam Up—Ready for Emergencies

And to do this work effectively the most improved machinery is installed. A powerful hoisting engine operates a 3-ton grab bucket suspended to an A-frame derrick, located on the forward deck.

An enormous towing machine is placed aft and controls 1,800 ft. of 2-in. steel towing cable. As lumber and steel are essentials in wrecking operations, the "Favorite" carries 50,000 ft. B. M. of the former and a carload of the latter, consisting of plates, channels and angles. A complete power saw mill han-



View Looking Forward—Electric Generators and Air Compressors—Machine Shop

dles the lumber and a fully equipped machine shop takes care of the steel for making repairs to sunken craft.

Thirty 100-ton hydraulic jacks are among the wrecking apparatus and powerful searchlights and submarine lamps are in the equipment to light up disabled vessels at night time and to enable the divers to work in submerged hulls. Powerful air compressors, electric generators and pumps of enormous capacity are included.

Complete stores of food for the men and fuel for the boat are constantly maintained, and when a call comes in the wrecker casts off and is under way with the same promptness with which a fire department on shore responds to an alarm.

GENERAL TROLLEY EXPRESS SERVICE

Arrangements are being perfected to inaugurate a general express system for operation on all electric lines. The service has already been started at Springfield, Mass., and will be extended all over the country as it develops. The method of operation will follow that of the big express companies. Separate express and freight stations will be established on all lines and cars of the usual type will be used for interurban express and baggage service. It is believed that the placing of the present rudimentary merchandise traffic of the different roads under one head will mark a period of greater efficiency and economy.

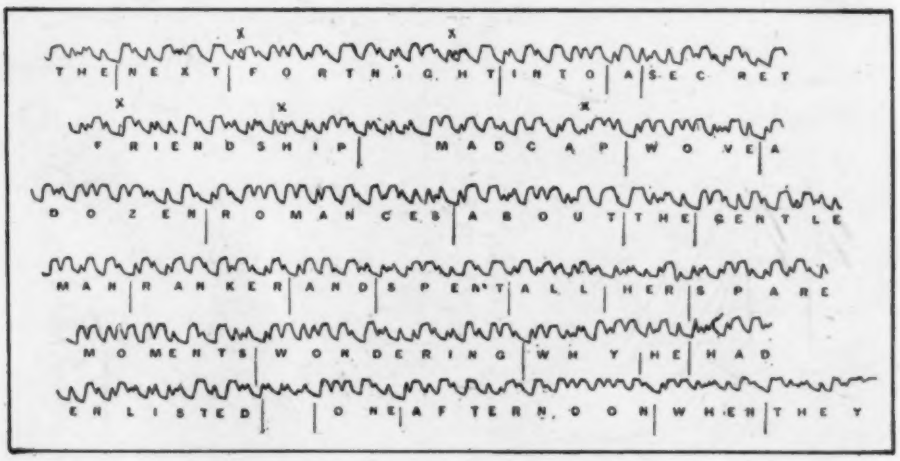
EXPERIMENTS IN HIGH-SPEED WIRELESS

The British postoffice department is carrying on preliminary experiments between two of its stations 15 miles apart for the purpose of developing high-speed work in wireless telegraphy.

In these experiments the received oscillations actuate a wireless receiver, which, in turn, acts on a syphon recorder, causing the Morse signals to be written in a continuous wavy line. The accompanying illustration is a reproduction of the actual received signals at a speed of 35 words a minute. The signaling was done as fast as the operator could send by hand. The speed was so rapid that he occasionally missed dots and shortened his spacing, as can be seen in the illustration.

"The results obtained indicate that Wheatstone working is a practical possibility," says the London Electrical Review.

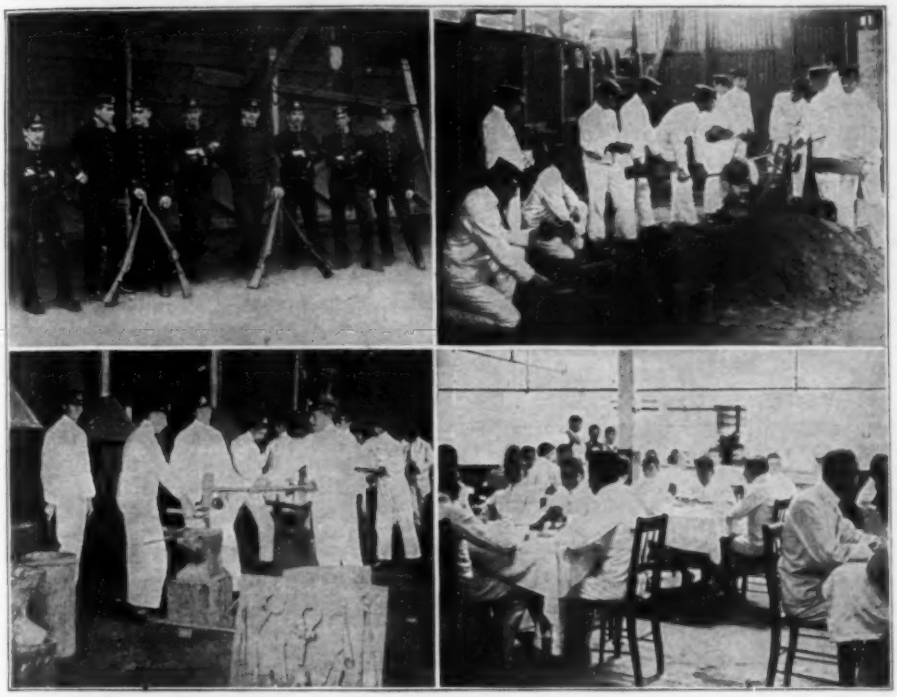
In other experiments the Wheatstone transmitter, which makes and breaks contacts in the primary circuit of the spark coil, is being used.


THE NEXT FORTNIGHT INTO A SECRET
FRIENDSHIP MADCAP WOVE A
DOZEN ROMANCES ABOUT THE GENTLE
MAN RANKER AND SPENT ALL HER SPARE
MOMENTS WONDERING WHY HE HAD
ENLISTED ONE AFTERNOON WHEN THEY

Wireless Message at 35 Words Per Minute and Translation

YOUNG MECHANICS IN THE CHILEAN ARMY

By Lewis R. Freeman



Squad Drilling

Blacksmith Shop

In the Foundry

Mess Room

There is a too prevalent tendency in the United States to rate everything connected with any of the South American republics—and particularly their naval and military institutions—as very rudimentary or hopelessly antiquated. As a matter of fact the general standard of civilization in Argentina and Chile is little lower than our own, and their military organizations, far from being the picturesque riffraff of cartoon and comic opera, will compare favorably on the score of personnel and efficiency with those of any country in the world.

For 20 years the Chilean army has been under the personal direction of a German, General Körner, and in every branch is observable that Teutonic thoroughness which characterizes its European prototype. In no department is this more marked than in the engineering corps, for which the courses of theoretical and practical training comprise all the latest features of those of similar schools in the United States and Europe. Some idea of the excellence of the scientific and manual training departments may be gained from the accompanying photographs.

NEW HOT-AIR FRUIT-DRYING PROCESS

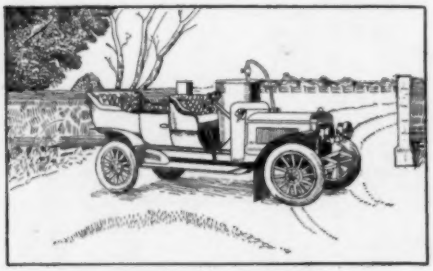
An invention which produces "naturally dried fruit" in an "artificial manner" by a hot air process, has just been tested before experts in California, and proven highly successful.

The fruit is laid in trays, constructed of wire netting, and a continuous draught of air heated to 150° is forced

through the fruit. Moisture extracted is carried away through an air stack and by control of heat and air, nature is closely imitated. The new process is claimed to do the work in two weeks less time than the field drying method and with the same result. The first tray of fruit, which happened to be prunes, taken out of the dryer was acknowledged by the experts to be exceptional. When weighed to ascertain the shrinkage by the new method compared with the old an increase of 10 points was noted in favor of the hot air.

AUTO RUN ON NATURAL GAS

At Medicine Hat, Canada, an ordinary automobile was run on natural gas without altering the machinery. The



Three Miles on Natural Gas

gas was contained in a steel tank 15 by 28 in. and was compressed to 75 lb., making the tank contain about 14 cu. ft. of gas. The gas was controlled by a globe valve and conducted through a rubber tube, one end of which was connected to the carburetor. The engine was started cold and made a run of 3 miles at a speed of about 9 miles an hour, the machine weighing 1,700 lb. It was estimated that about 10 cu. ft. of gas was used in the run.

WHY RIFLED PIPE LINE TRANSMITS FASTER

The secret of the more rapid transmission of oil through a pipe line proves to be water. The 256 miles of 8-in. rifled pipe of the Southern Pacific will transmit 23,000 bbl. of fuel oil each 24 hours.

An exhaustive series of experiments has demonstrated that after a small per cent of water has been added to the oil, and the necessary pressure applied, that the whole will develop a whirling motion, and that the water being the heavier will seek the outside of the pipe, thereby enveloping the oil in a thin film or shell of water; this shell or film of water acting as a lubricant between the oil and the pipe, and thereby greatly reducing the friction and allowing the core of oil to glide through the pipe readily.

FALL OF QUEBEC CANTILEVER BRIDGE EXPECTED BY MEN

As an aftermath to the horrible cantilever bridge disaster at Quebec, in which 80 men were killed, comes the report that nearly every man working on the structure knew of the peril three or four days before it occurred, and that a telegram sent by the consulting engineer to his foremen the day before the crash, ordering suspension of work, was delayed until too late.

"My inspector told me two days before the disaster that things did not look well at the bridge and that it ought to be looked into immediately," said the consulting engineer of the bridge company. "I wired my men to

Steam Rail Motor Coach, Toff Vale Railway

get off the bridge and stay off until it had been examined, but the telegram was probably delayed by the telegraphers' strike."

One of the workmen, a structural iron worker, said that for several days rivets had been snapping and that he and 40 companions, believing that the structure was unsafe, quit work two days before the disaster occurred, although the bosses tried to argue them out of their fears.

There were 18,000 tons of steel in position when the structure fell, all of which went down on the rocks or into the river, which is 180 ft. deep.

WHALES STILL HUNTED

But not so much as before mineral oil was adapted to so many uses. This has given the whales a chance to increase and they still furnish a lucrative industry to those who hunt them for their oil, which possesses peculiar advantages for certain uses, and for the rare ambergris, more precious than gold. The latter is a morbid growth in the whale's intestines.

Whale oil is best for tempering because its fire-test is very high. It is used in cotton and woolen mills as a lubricant because it saponifies readily, and because a spot of it on the goods is removed easily without stain; it does not gum, nor become rancid, and heat affects its thickness but slightly.

Though the ancient glory of New Bedford as the headquarters of the whaling industry has departed, it still sends out a fleet of 30 sail and steam craft to fish for leviathan, and there are two others in commission at Provincetown. So far as known, these two ports are now alone in fitting out whalers, San Francisco having gone out of the business. Although the business is not big, according to modern standards, the annual receipts of oil at New Bedford average 12,000 bbl., valued at $335,000. The bark "Greyhound" recently brought in $80,000 worth of sperm oil from a four years' cruise off Brazil and Patagonia.

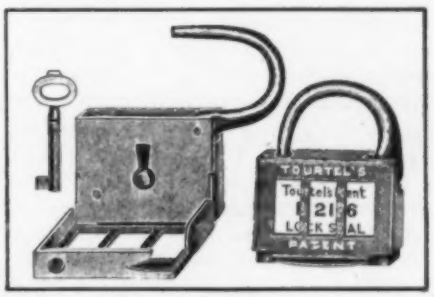
THE ARMY IDENTIFICATION TAG

By a recent general order the War Department has directed that in future all men and officers shall wear as a part of their field equipment a small aluminum identification tag, on which will appear the owner's name, rank, company, and regiment.

This little tag, somewhat larger than a silver quarter, is to be worn inside the shirt, suspended from the neck by a cord, and is to be furnished without charge to all enlisted men, and at nominal price to officers. It is strange that so simple a method of identifying killed and wounded soldiers should not have been adopted before this date.

A NEW TYPE OF PADLOCK

The illustrations show a new form of padlock used for meters, scales and articles of a like character. The seal is effected by the printed slip of paper over the keyhole. All locks are opened



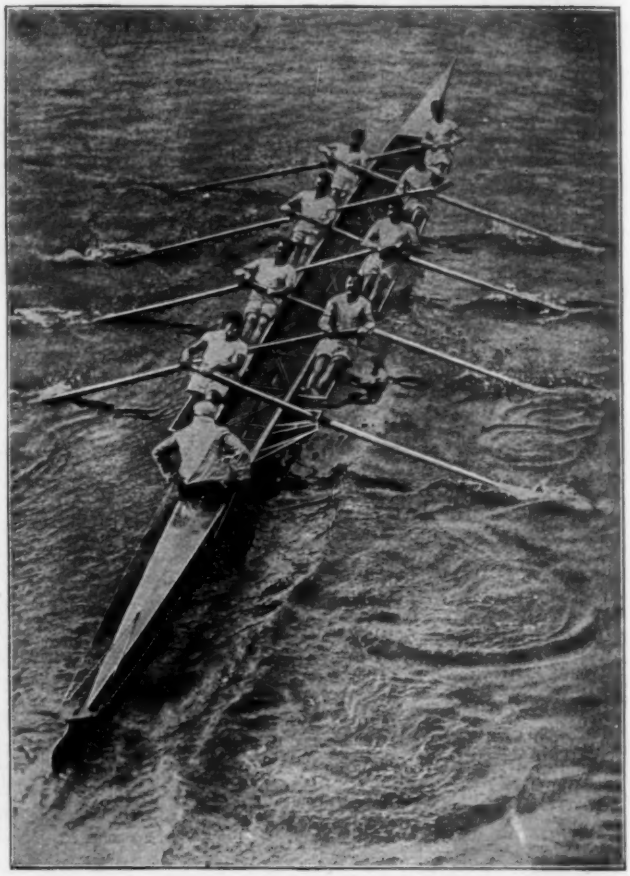
For Sealing Meters

by the same key, and it is said that the numbered slips render it impossible to tamper with the meter without detection.

OUTSIDE SEATS FOR RACING SHELL

A freak eight-oared racing shell with seats for all the oarsmen outside the boat, is suggested by B. A. Jessup, an American champion. He does not claim the boat can be used in any but smooth water. The purpose in placing the seats outside is to secure an additional two feet of leverage in the oar.

Experts are not agreed as to the utility of such an arrangement, and Lehmann, a prominent English sportsman, pronounces it absolutely impossible in real racing.



LIME TO PROTECT OYSTERS

One of the greatest foes to the oyster industry is the starfish, which frequently covers large areas of the sea bottom to a depth of 18 to 20 in.. sometimes blanketing entire beds of oysters. The stars are very hard to destroy, but it has been discovered that their steady advance can be checked with lime. The lime is placed in paper bags and dropped along the boundary of the oyster bed. The paper bag causes it to descend through the water, and beyond the lime barrier thus formed not a starfish will pass. A better means for getting the lime to the bottom is being devised.

The first of the two tunnels under East river and connecting New York and Brooklyn is practically completed and will be opened to traffic the first of November.

CONCRETE FOR SMALL CULVERTS

Concrete has a place for itself when used in the construction of small culverts. A prominent railroad system recently built 306 lineal feet of concrete culvert at less than one-third of what cast-iron pipe would have cost.

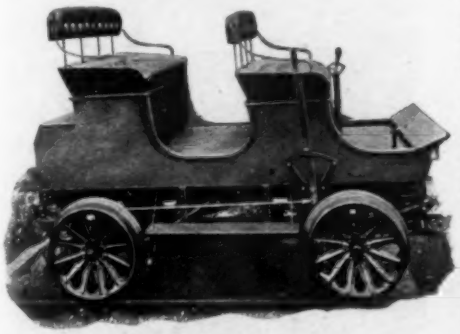
Crushed stone and screenings were used in the mixture and small spandrel walls were built at the ends of each culvert. It was necessary to haul the materials for a distance of a mile. This haulage is included in the cost.

A cast-iron pipe having the same section of water-way as the culvert

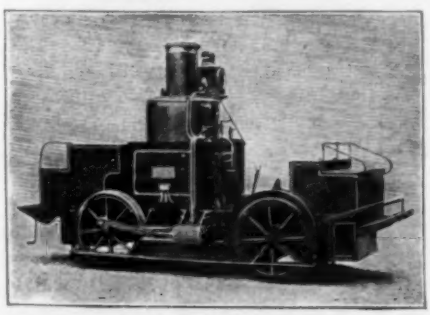
would weigh 450 lb. per foot and cost $9 per foot after being placed in position, making the total cost of pipe $2,754. The accompanying table shows the cost of the concrete construction per running foot: Labor, $1.45; stone and screenings, at 50 cents per yd., 25 cents; cement, at $1.97 per bbl., $1.01; forms, 4 cents; total, $2.75.

RAILWAY INSPECTION CARS

Small self-propelled inspection cars are rapidly coming into use on all the steam roads. The scarcity of locomotives to draw special cars has had much to do with this condition, and besides it is much cheaper to run the small motor. Two types of these cars are seen in the accompanying illustrations. The first is an American built car operated with automobile gas engines which develop a speed of 40 miles an hour. The car is built of steel and carries a gasoline supply for 150 miles.



American Type



Used in Argentine

The other is an English type, built for use in Argentine, and is a steamer. There is a front seat for two passengers and a rear platform for the engineer, who also does the firing. This machine is also capable of 40 miles an hour.

By a simple contrivance a railroad manager in India has rigged up an automobile so that it can be used on the highway or on rails. The only alteration necessary is the addition of a sprocket on the rear wheels of the truck. Mounted on the axle of these wheels is a drum from which a broad belt is run to a similar drum on the leading wheels. The rail-gauge is only 2 ft. and the entire under-frame fits inside the springs. The manager of the line uses the automobile to run down from Darjeeling to the plains, then the car is lifted off the trucks and placed upon its road wheels. The grade of the Darjeeling railroad varies from 1 in 30 to 1 in 24, and for 40 miles is all uphill in one direction.

Rails or Highway—India

The car makes the grade at an easy 20 miles per hour.

Herr Mauser has invented what he considers an improvement on his well-known rifle by which it reloads itself automatically from a cartridge chamber.

ELEGANCE OF MODERN STEAMSHIPS

Palatial Quarters and "Marble Halls"

The "Kronprinzessin Cecilie," the new ship of one of the German lines, is a marvel in artistic interior finishing. The dining room has been done in Florentine Renaissance, of a white tone, richly covered with ornaments.

The Dining Room

Sixteen pillars carry a glass-roofed dome. Behind the pillars, the balustrade deck is visible, projecting in the corners in pulpit form. The carved lower balustrade shows two reclining figures in the middle of each of the four sides, containing busts of the crown prince and crown princess and their coat of arms in bronze relief. The sides of the dining room are partly ornamented with paintings of scenes and landscapes around Mecklenburg. The staircase leading to the upper decks is in bronze and wrought iron.

The smoking room is decorated in modern Roman, with a central dome supporting a glass roof. The lower part is decorated in white, with leather tapestry. The seats are covered with greenish-blue leather. As in the dining room paintings show scenes from the home of the crown princess.

The music room is decorated in the Empire style. The walls are covered with red silk tapestry, and chairs and carpets match the color. A life-sized oil painting of the crown princess looks down from the forward wall.

First Cabin Smoking Room

Reading room, library, and writing room are decorated in white. The furniture is of mahogany, covered with blue gobelin. The children's dining room is covered with blue tapestry, the upper part showing pictures of scenes from childhood life, together with reliefs from well-known fairy tales.

SUCTION DREDGE WORKS CLAY

The contention of dipper dredge builders that suction dredges will not operate successfully in clay is not borne out by Government reports. One engineer in charge of work at Galveston reported moving 218,505 cu. yd. of

mud and clay at a cost of 7.4 cts. per cu. yd. This was done by a suction dredge. Just previous to this a dipper dredge had removed 32,698 yd. of the same material at a cost of 35 cts. per cu. yd.

In 1906 the suction dredge "Caucus" operated in Pensacola harbor for almost a year. During the time 592,018 cu. yd. of coral, sand, and hardened clay were removed at a cost of 6.09 cts. per cu. yd.

It is said when the dredge "C. B. Comstock" is working on a clay bottom and with the pumps running 255 revolutions per minute that the clay comes out in cubes 6 and 8 in. large, and that the spoil bins fill more quickly than when sand is being pumped.

FISH KEPT ALIVE OUT OF WATER

It has remained for the Germans to perfect a scheme whereby live fish may be delivered no matter what the distance from the sea. Dr. Eugene Erlwein is the inventor of an apparatus which keeps them alive when they are out of water.

The fish are placed upon shelves in a case, which has its floor covered with a thick layer of wet cloth. This keeps the air in the receptacle very moist and the gills of the fish never become dry, but move almost as freely as when in the water. Oxygen is first passed through water and then into the case. The fish breathe it through their moist gills as readily as though in water; excess gases escape through a waste pipe.

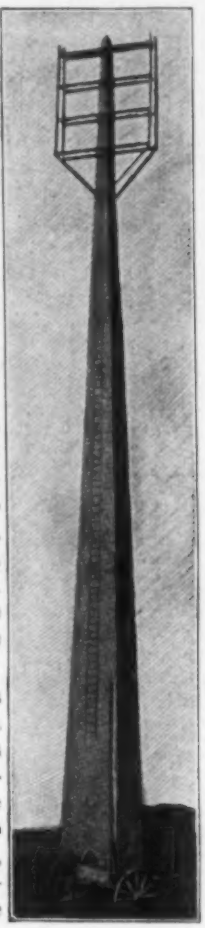
This treatment apparently in nowise injures the fish, although if again placed in water they appear sluggish for about 10 minutes or until they become reaccustomed to the decreased supply of oxygen.

The case Dr. Erlwein experimented with contained 300 lb. of fish and only weighed 100 lb., which makes only one-fourth dead weight. He has carried his experiments farther and has patented a fish car embodying the principles outlined.

CONCRETE SHAFT 115 FEET HIGH

Largest Construction of the Kind Ever Attempted

An electric company has completed a huge reinforced concrete tower 115 ft. high. It will carry 16 transmission cables across the Monongahela river at Brownsville, Pa. The U. S. government regulations are such that the tower must support the wires across a span 1,014 ft. long, and at least 79 ft. above low-water mark.



115 Feet High

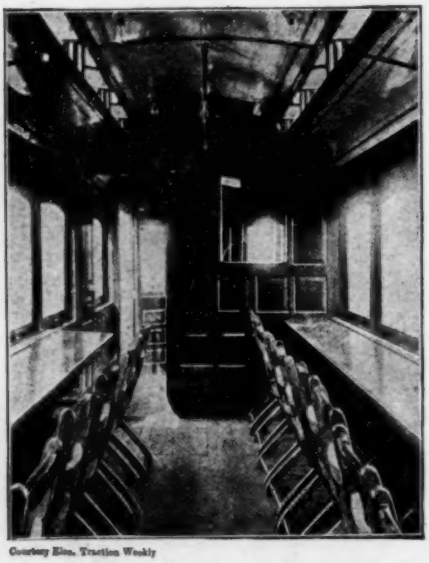
The tower is built in the form of a square. It is 8 ft. 2 in. on a side at the base, and tapers to 1 ft. at the top. It is hollow for a height of 84 ft. from the ground, the walls being 1 ft. in thickness, and reinforced with old steel rails and scrap iron. The tower is solid for the remaining 31 ft.

Bed-rock was found at so great a depth that its use as a foundation was impractical. Therefore it was decided to build a concrete base, to carry the enormous weight of the structure. Concrete was reinforced with old rails, laid criss-cross, and made into a block, 30 ft. square and 4 ft. 6 in. deep, at the center, with the top tapering away to 1 ft. 6 in. at the edges. The false work which supported the forms and extended to the top of the tower was 12 ft. square. Fifteen men were occupied on the construction for a period of 25 days.

AN EMPLOYMENT OFFICE THAT COMES TO YOU

One of the latest innovations in electric cars is an employment office car, which goes after the men seeking employment instead of compelling the men to come to it.

This car was placed in operation by



Courtesy Elec. Traction Weekly

The Traveling Office

an electric railroad company in New Jersey, the lines of which are scattered all over the state. On a special schedule card, certain hours of each day are advertised as application days in each of the different cities and towns along the line. Under this scheme the applicants find it as convenient to apply to the company for positions as to any local industry.

The car is so arranged that the superintendent of employment can use the time going to and coming from designated points to do a certain amount of business. The applicant is first weighed and measured on the rear platform and then passes into the first compartment, where he is questioned by the superintendent. If found satisfactory he is passed through to the body of the car, which has a long desk on each side and chairs to accommodate 15 men. Here the application blank is filled out and the applicant waits until it is approved and he receives his order to report for duty.

ARCHES OF CONCRETE FOR MINE ROOF SUPPORTS

Arches of concrete to support mine roofs are being used in Pennsylvania collieries as substitutes for timber supports, always breakable, and now very expensive owing to the growing scarcity of timber.

The first of these arches was installed over a year ago. Since then many more have been constructed, none of which have shown the slightest crack or sign of weakness. The concrete forms for the arches were constructed immediately adjacent to the timber sets. After the concrete has set for two weeks the timber supports were removed, leaving the old lagging resting on the concrete. As these rot they will be replaced with old mine rails.

The arches are built 18 in. square in cross section. The first were stiffened by old mine rails. Later steel rope, woven through the concrete, was used. The majority of arches were provided with concrete legs, but several have been built into hitches cut into the top and bottom slate. The estimated cost was $22 an arch.

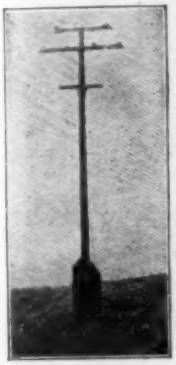
FOLDING LAUNCH COVER

The illustration explains the arrangement of the folding cover, which can be opened or closed in three seconds. When not in use it collapses into small space on one side the cockpit.

Closes in Three Seconds

CONCRETE BASE SAVES POLES

A concrete base for telephone poles as a preventive against decay is now being used in some parts of the country. Working on the theory that the poles generally commence to decay first just beneath or on a level with the ground line, the concrete stub or base is placed in the ground. The top of the base rises about 3 in. above the surface of the soil or rock foundation. The pole is placed upon the concrete base and securely fastened with clamping irons and bolts.



In case a pole, already doing service, has decayed near the base, but otherwise is solid, the stub is sawed off at the desired distance from the ground and the pole supported upright while the decayed part is removed and the concrete base substituted.

It is claimed that two men can install a stub an hour in rocky ground. The work of placing the poles requires only two men and a team.

PRESERVATIVE POWERS OF CLAY

Observations on this subject have proved that wood driven or placed in clay is as completely preserved as though immersed in water. Wooden water pipes buried so many years that record of them had been completely lost were dug up in Boston a short time ago and found sound, owing to the dense clay that surrounded them.

In the construction of foundations in the lower parts of New York, stringers and mud sills which had been placed above water level in clay more than 100 years ago, were found in good preservation, while the same material surrounded by other soil had completely rotted away.

AUTOMATIC EXPRESS CALL

An automatic express call for large office buildings has been invented which consists of a distributing box on the first floor, which is connected with every floor in the building by a tube, similar to a mail chute. The distributing box is divided into compartments bearing the names of the express companies and each office in the building is provided with small metal discs, varying in size, on each of which is the

The Disc Drops to Its Box

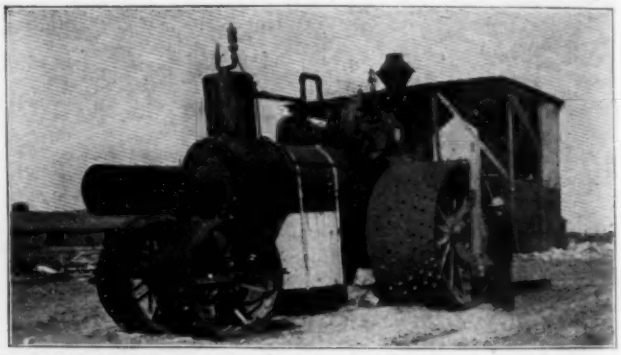
name of an express company represented in the box, and the number of the room.

The person who wishes to send a package selects the disc of the company he desires and places it in the slot of the tube on his floor. The disc drops to the box and slowly rolls over the distributing plate shown in the illustration until it falls into the proper compartment. This makes an electrical contact which automatically displays

the sign of the express company on the outside of the building. The driver, seeing the sign, unlocks the compartment of his company and from the number on the disc knows where to go after the package.

FIGHTING PRAIRIE FIRES WITH STEAM PLOW

Plowing up the sod along railroad tracks has been found to be an effective means for combating prairie fires. This method is now being used on the Canadian Pacific Railway. These fires became so menacing that the officials of the road put their heads together and the result was the odd looking engine shown in the cut. It is used for ploughing the fire-guards along the main line and also for hauling long lines of auxiliary plows rushed to any threatened point.



This Machine Ploughs the Fire-Guards

COUPONS EXCHANGEABLE IN FOREIGN COUNTRIES FOR POSTAGE

Coupons, enabling persons to send return postage to foreign countries, or pay small accounts without the trouble

Exchangeable for Stamp

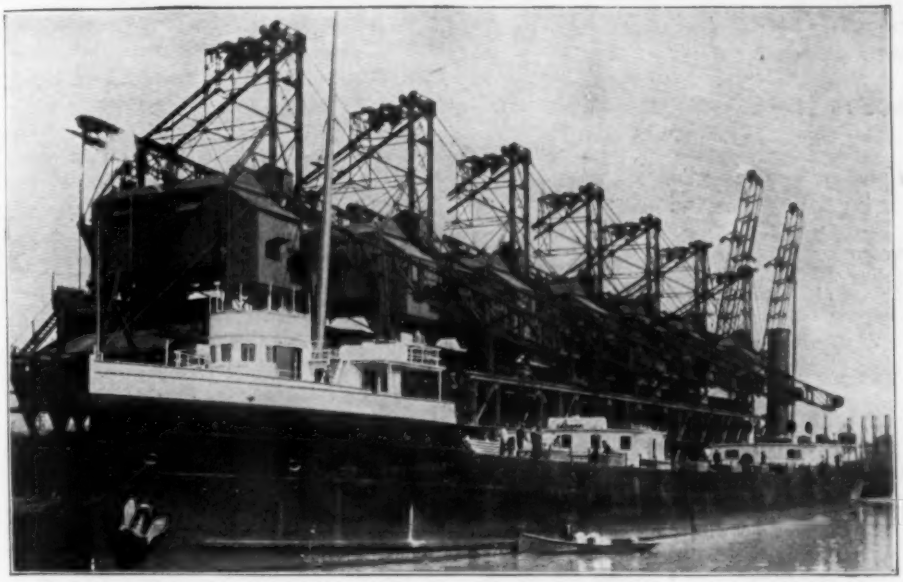
of procuring money orders, were issued October 1 by the postal departments of the United States and nearly all of the civilized countries of the world. Hitherto this has been impossible because the stamp of one country is useless on a letter starting its journey from another country.

These coupons designated as "International Response Coupons," cost 6 cents and will be exchangeable in any country which has signed the agreement for a stamp equivalent to a United States 5-cent stamp. The design of the coupon bears the two hemispheres, an artistic figure of a woman with arms outstretched connecting them, and lettered words explaining its nature. The sender places the coupon, which is printed on bond paper, 3 by 4 in. in size, in the envelope and the recipient exchanges it at the local office. All canceled coupons will be sent to an International Clearing House located at Berne, Switzerland.

Although the scheme, adopted by delegates of most of the civilized nations at the postal congress held in Rome, is not made compulsory, the following nations have signed the agreement: The United States, Great Britain, Germany, France, Austria, Spain, Japan, Holland, Norway, Sweden, Belgium, Denmark, Switzerland, Greece, Bulgaria, Crete, Luxumburg, Roumania, Siam, Hungary, Korea, Mexico, Costa Rica.

Commodore Peary's polar cruise has been abandoned for this year, as it was found necessary to fit the arctic steamer "Roosevelt" with new boilers.

BIG ORE DOCK AT ASHTABULA MOVES 1,000 TONS AN HOUR WITH 5-TON BUCKETS



Seven Great Machines for Unloading

The Union ore dock at Ashtabula harbor is one of the new and finely equipped docks which have enabled that port to double her capacity in the last three years. The doubling of the capacity of Ashtabula harbor means much to the traffic of the lakes, for Ashtabula has long been known as the world's greatest ore-receiving harbor. The dock is equipped with seven machines for unloading; the buckets used are of 5-ton capacity. The seven machines will remove about 1,000 tons per hour from a modern ore carrier.

SKYSCRAPER CITIES IN DANGER OF CONFLAGRATION IN MID-AIR

The unlimited height of buildings in the big financial centers of the country, where the streets are being converted into narrow cañons by the walls of 30- and 40-storied buildings, will be the cause some day in the near future, according to the president of the New York Board of Fire Underwriters, of a devastating fire which will leap from skyscraper to skyscraper while the firemen swarm like ants impotently below.

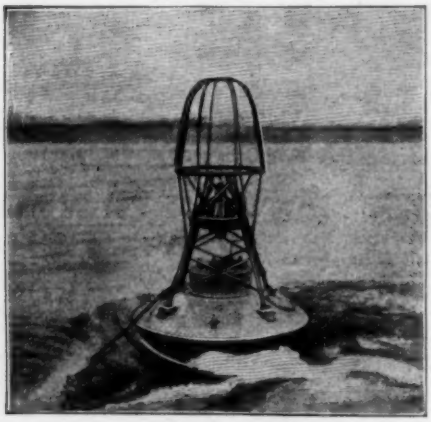
To make impossible a still greater increase of this danger in New York by the erection each year of more skyscrapers, the commission on the limitation of the areas and heights of buildings, was urged to recommend legislation limiting the heights and areas of buildings all over the city. One of the recommendations was the limiting of non-fireproof buildings to be used for commercial and manufacturing purposes, to a height of 55 ft. For fireproof buildings, provided with automatic sprinklers, and designed for office use only, a height of not more than 125 ft. was advised. Any height above

these figures was declared to be courting certain peril.

Legal and economic objections would complicate such a regulation, but the commission agreed that some sort of regulation should be enforced, and better today than 20 years from now.

ACETYLENE AS GUARDIAN OF THE SEA

If Your Light's Out—You're Out, Motto of Light-House Service—English System of Dues



Acetylene Buoy Light

The requirements of keepers of United States light-houses, any omission of which might result in the wrecking of a big ship on treacherous shoals, and the loss of hundreds of lives, were explained at the International Acetylene convention held in Washington, at which acetylene was heralded as the light of the future for guarding the sea.

"When the light goes out—you go out" is the motto of the United States light-house service. The board receives no excuses from the light-house keeper. His light must shine its warning to passing ships. From the time a keeper enters the service until the finish he is fully impressed with this idea. Ducks and geese may break through the quarter-inch French glass protectors and attack and destroy the lens, putting the light out of commission. In such a case the keeper must immediately hang up a lantern until the lens is replaced.

"If a keeper's light goes out he goes out of the service with it," said Captain A. Ross, U. S. N., member of the light-house board, who spoke before the convention. "So we desire the most efficient, and yet most economical, light in the market. The law allows us only a certain number of light-houses, buoys, and keepers. Money has a great deal to do with the efficiency of the service. We cannot pay more than an average of $600 per annum for each keeper."

The English system runs to the other extreme, too many lights being more of a possibility than too few. Ships entering English ports are compelled to pay so much per ton as lighting dues, for every light passed upon the voyage. This is carried to such an extent that ships pay dues on lights they pass hundreds of miles away. American line steamers from the United States to Liverpool pay an average of about $250 each trip for the maintenance of these lights.

PRISONERS MAKE ROAD SIGNS

The making of road signs, a unique industry for prisoners, has been installed by the Prison Department of the State of New York in the Clinton prison at Dannemora, N. Y.

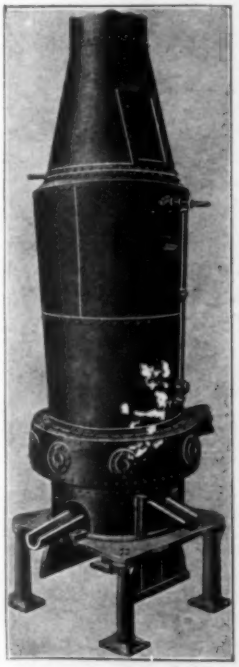
The aim of the prison authorities is for the prisoners to produce a road sign weatherproof at all seasons of the year. To accomplish this the boards are made of seasoned 1-in. white pine, well protected with paint. The lettering is painted in black on a white background and is clearly legible at a distance of 50 ft. The painting is thoroughly weatherproof and the signs are expected to last indefinitely.

The boards are attached by bolts and nuts to wrought-iron standards, heavily coated with white lead as a rust pre-

ventive. The signs are made in a variety of styles and sizes, depending upon the nature of their location and use. The largest size makes possible the painting of the names of 10 or 12 towns and distances upon the two boards placed at right angles.

REFINING COPPER SCRAP

The ever increasing demand by refiners for old copper, brass and other alloy metals has given rise to the comparatively new industry of refining non-ferrous metal. All over the country scrap dealers are at work gathering together this waste metal, one of the most important items of which is copper.



Reverberatory Furnace

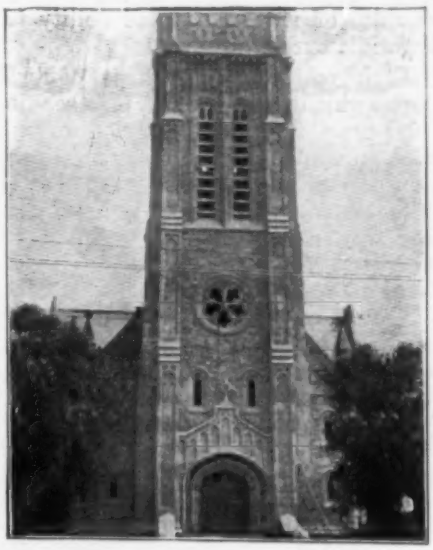
Metallic scrap copper is melted in a reverberatory furnace. The slag, consisting of from 30 to 70% copper and impurities contained in the charge or caused by combination with oxygen and the fire brick lining of furnaces, is recovered by smelting in a cupola of small round water jacketed blast furnace as shown in the cut.

REMARKABLE ELEPHANTS!

A tale comes from Wheeling, W. Va., of a wise elephant who lifted an engine from the body of a pinioned engineer, and eight other elephants who, filling their trunks with river water, extinguished the flames and distinguished themselves.

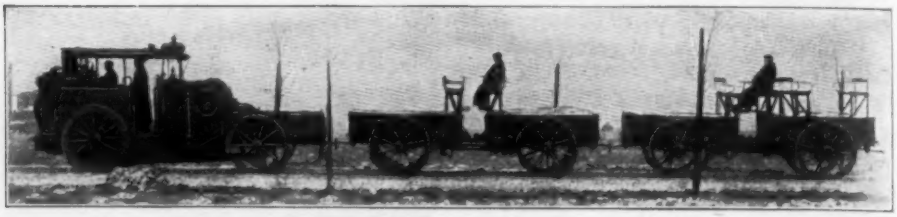
Propelled by blades arranged spirally around a shaft which revolves inside a cylinder, this quaint craft, called "The Typhonoide," is expected by its inventor, a Frenchman, to reach a speed of 60 miles an hour. The cylinder runs the entire length of the keel, somewhat resembling "Archimedes' screw." According to its inventor, the boat has already attained a speed of 40 miles an hour.

CHURCH BUILT OF CEMENT BLOCKS



The use of cement in the construction of public buildings is rapidly increasing. The church illustrated cost $125,000; the interior walls are of common brick, but the exterior, including the spire is of cement blocks, either rock faced or plain finish.

STEAM FREIGHT TRAIN FOR THE HIGHWAYS



Hauling at Three Cents a Ton Per Mile

On the highways in the vicinity of Seegefeld, near Spandau, Germany, a steam-driven vehicle train of novel type is regularly engaged in the transportation of heavy merchandise. Both the locomotive and the wagons which it pulls are of original design. The latter, as may be seen from the accompanying illustration, have extremely large wheels, with the corresponding advantage in ease of traction; but the construction is such that there is no sacrifice of flexibility or of ability to negotiate curves.

Each vehicle unit consists of two parts which are coupled together to form practically a four-wheeled wagon. The coupling is rigid in the direction of vertical stresses, but free bending movements sidewise are allowed and regulated by the curved bumpers which are fitted with cogs and which mesh like sections of gear wheels at the coupling. By this means the train can take curves of 23 ft. radius and drive backward or forward on either a curve or a straight line.

The locomotive operates by steam generated in a water tube boiler. The fuel used is oil, which is sprayed into the fire-box by steam. The capacity of the locomotive is 30-hp. and the consumption of fuel per horsepower hour is said to be about .22 gal.

It is claimed that the trains can carry a net load of 20 tons on a level at a speed of 5 miles per hour and can take gradients up to 1 in 20. The working cost by the system is said to be about 3 cents per ton mile. A sufficient quantity of water and oil fuel are carried to give the train a radius of action of 50 miles.

QUEER HORSE POWER FERRY

This type of river ferryboat propelled by horse, like an old-fashioned threshing power outfit, was formerly to be

seen on the Mississippi river. As the horses traveled in a circle the power was transmitted to stern paddle wheels. Ferries of the same construction have recently been discovered in Central Asia.

In a Paris church a gramophone in the chancel makes the customary responses for mass and also sings the canticles.

The Japs have ordered from Germany new guns and ammunition worth $10,000,000; also, ten war balloons.

SHOP NOTES

To Remove Rusted Nut

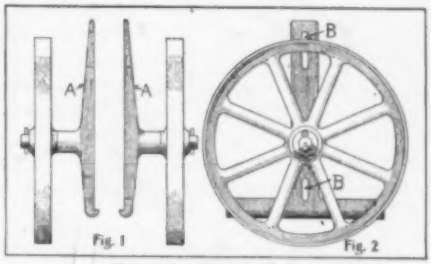
A nut sometimes is rusted to a bolt so solid that it is impossible to remove by ordinary means. To force it with a wrench would only result in breaking the bolt and causing a large amount of extra work, says The Automobile. The only thing to do is to sacrifice the nut by splitting it with a chisel, as shown in the sketch.

Cement Piers for Scales

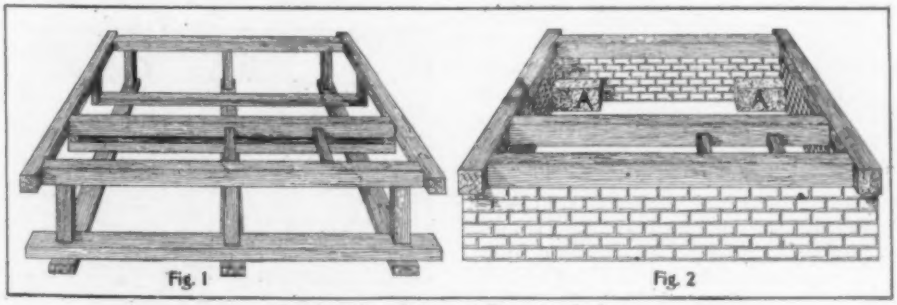
The use of a wood frame support for scales if placed in a pit causes too much dampness for the wood timbers and in time they will rot. Fig. 1 shows how a common wood frame support is constructed before placing in a pit. A correspondent of American Miller constructed a support as shown in Fig. 2 with 6 in. by 8 in. sills placed on a brick foundation and with cement piers built in the corners AA. These piers were made 1 ft. high, on which were placed the saucers that hold the balls. Just as the cement was about hard the saucers were fastened to the cement with lag screws. When the cement set this made the saucers firm and solid.

Special Engine Frame Truck

In railroad shops, where it is necessary to remove a frame from a locomotive and transfer it to another building on the grounds, a truck of some kind must be used. The accompanying sketch shows how such a truck may be made for this purpose. The truck is constructed entirely of iron with cast iron wheels 32 in. in diameter. A wrought iron tire $\frac{5}{8}$ in. by $3\frac{1}{2}$ in. is shrunk on the rim of the cast wheel. The jaw and axle (A, Fig. 1) is made of one forging or casting. It takes very little time to fasten an engine frame between the jaws AA with bolts through the slots BB. A heavy engine frame can be taken any place about a



Truck for Engine Frame

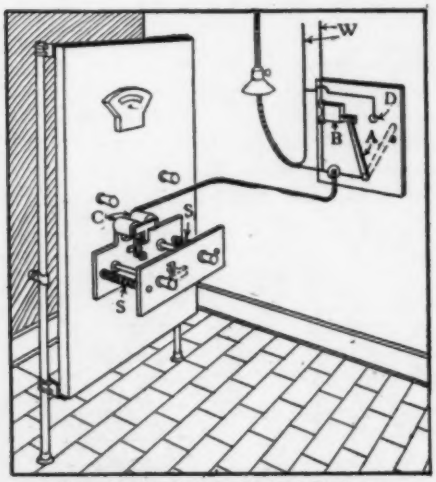


Construction of Cement Piers for Scales

large shop in this manner.—Contributed by D. H. Utter, Sayre, Pa.

Pulling Arc Light Switch Plugs from a Distance

In a certain place which was a long distance from the station switchboard and where old iron telephone wire was



Operating Switch Plugs from Distance

used to close the circuit, an arrangement as shown in the accompanying sketch was made to draw the plugs on an arc light switchboard.

The coils, C, which release the springs, S, on the plug drawing attachment are coils from an old arc light. These coils are operated through a local circuit using an ordinary buzzer, B, for a relay, which releases a small arm, A, operated by a spring, making a momentary contact on point D, thus closing the circuit through the coils. The wires, W, are the iron wires connected to a push button at the house.

This could be used nicely without the relay attachment if the distance were short. As the house is some distance from the station and an old iron telephone wire was used, the resistance was such that the main coils could not get enough current to operate them with success.—Contributed by H. S. Brink, Fort Des Moines, Iowa.

To Print on Tracing Cloth with a Rubber Stamp

Prepare the part of the tracing to be printed by scouring it good with pulverized French chalk to remove any grease spots and after dusting off all loose chalk apply the stamp in the usual manner, using any good brand or color of glycerine stamping ink.

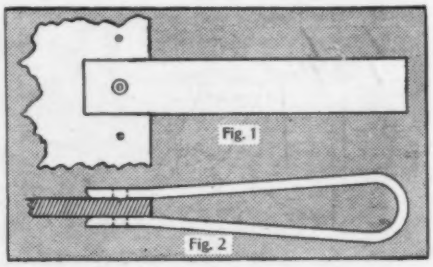
After the stamp has been applied cover it again with pulverized French chalk, this time rubbing it lightly with the finger until the ink forming the letters has soaked up enough chalk to make them appear raised. Then dust off the loose chalk and the tracing is ready to use.—Contributed by E. W. Bowen, Denver, Colo.

Uniform Heat for Melting Brass

In melting brass or similar metals, too strong a heat is detrimental. Portions of the metal exposed will be melted and oxidized before the remainder is melted, says Brass World. The best practice is to have the metal melt as uniformly as possible so that all portions become liquid at about the same time. This avoids overheating any portion of it.

Transferring Punch Marks on Boiler Plate

The sketch shows a device for use in boiler shops, where, as it frequently happens, it is required to transfer a prick punch mark from one side of a marked plate to the other. Its application is shown. The two holes in the

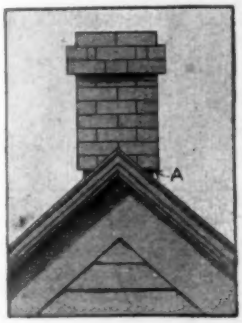


For Transferring Punch Marks

jaw are drilled in line and the one hole is placed so as to register with the punch mark (Fig. 1) and the spring of the jaws holds it in place, so that the plate may be turned over (Fig. 2) and the other center scribed or prick-punched, as may be desired. Any piece of flat steel may be used that has spring enough to adapt it to the thickness of the various plates.

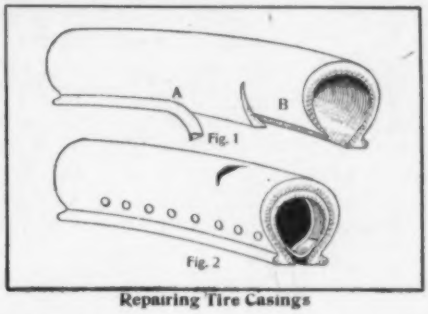
What to Prevent in Building a Chimney

The settling of a chimney when built on a frame roof is not always taken in consideration and the result is that the extended part of the chimney, shown at A in the sketch, is left to rest on the roof and the part below settles and leaves a crack through the mortar and brick. Many fires have been caused by this fault of construction. Enough space should be allowed for the settling at point A.



How to Repair Tire Casings

An old tire casing that may not be in a condition to warrant the repairing by a regular repair man can be put in condition to get several hundred miles of service from it, says The Motor Way. If it is blown out, carefully clean the inside of the cover with gasoline for about 5 in. each side of the hole. Then take one of your covers that is in bad condition and cut a section, about 10 in. long, out of the best part of it; cutting the beads, A, Fig. 1, from it and trimming it with a sharp knife at the edges to a thin edge, as shown at B. Carefully clean the outside with gasoline and when ready apply three coats of solution to the inside of the shoe to be repaired, allowing each coat to dry well, also about two coats on the outside of the repair piece, and apply together as you would a patch on an inner tube.



Repairing Tire Casings

Rivet the patch to the tire casing by using small copper rivets or split rivets in a single row, about 1 in. from the bead (Fig. 2), placing the rivets about 1½ in. apart. After this is done canvas should be cemented to the inside of the casing, covering the entire patch, so as to make a smooth surface for the inner tube.

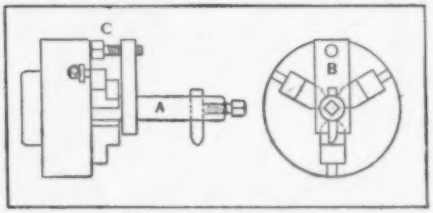
To Remove the Odor of Paint

Place a vessel of lighted charcoal in the middle of the room and throw two or three handfuls of juniper berries on it. Shut the doors, windows and all means of ventilation for about 24 hours and the smell will be entirely gone. This process will not injure curtains, carpets or furnishings.

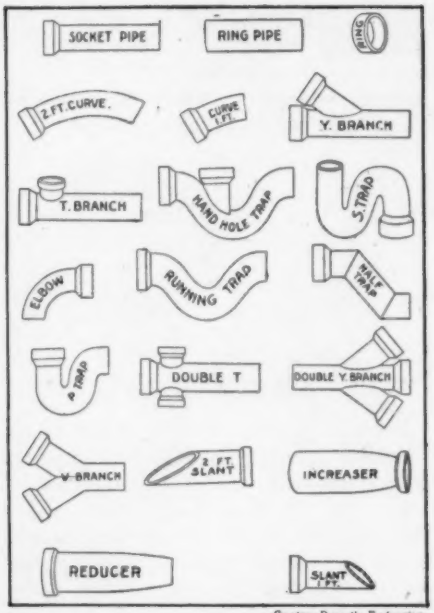
How to Make an Adjustable Boring Bar

A quickly made adjustable boring-bar can be constructed as shown in the sketch, says the American Machinist.

The adjustments of the bar, A, are obtained by the screw, C, which passes through the plate, B, and bears against the face of the three-jawed chuck.



Adjustable Boring Bar

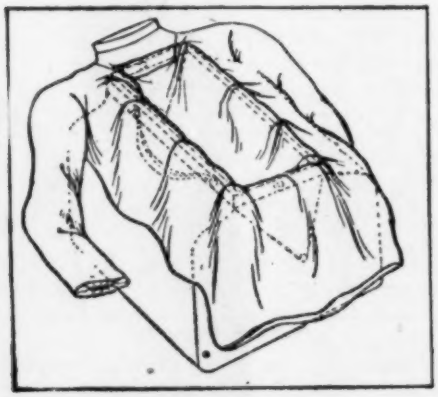


Courtesy Domestic Engineering.

Types of Sewer Pipe Joints

Emergency Tire-Testing Tank

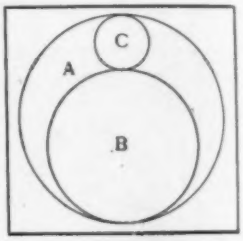
The accompanying sketch shows what may be done with the ordinary materials that are carried in an automobile at any time. A traveling grip, emptied of its contents, with any water-proof garment pressed down into its mouth, can be filled with water, says a correspondent in The Motor Way. With this aid a puncture can be easily located. If there is no water at hand the water from the acetylene generator can be used, even though there is a small quantity, as the shape of the tank can be changed to fit the tube.



For Locating a Puncture

Changing Pulleys

In changing pulleys on line shafts or other places it may be desirable to know how much to cut out of or add to a belt, and have it come right. That is to say, if a belt runs over two pulleys 30 in. in diameter, and the pulleys were to be changed to 36 in., the belt would need to be as much longer as one pulley is larger around than the other.



The difference of the distance around two pulleys of unequal size is the same as the distance around a small pulley the diameter of which equals the difference between the diameters of the two, says Power and Transmission.

For instance: the distance around a 14-in. pulley is 44 in., and the distance around a 21-in. pulley is 66 in.; but, knowing the fact that the latter is the same as the distance around a 7-in. pulley, it is only necessary to determine that to get the correct result, 22 in.

The circumference A in the illustration equals the sum of the circumferences of the two, B and C.

Care of Paint Brushes

Always clean a new brush before putting it into paint. Work it briskly back and forth through the hand until most of the dust and loose bristles are out, soak in water until wet through and then swing and shake till dry.

For varnish and buggy paint the brush must be more thoroughly cleaned, until all loose hairs are out. Brushing it over sandpaper is good. Wash out in turpentine, not water. When not in use keep suspended in the varnish.

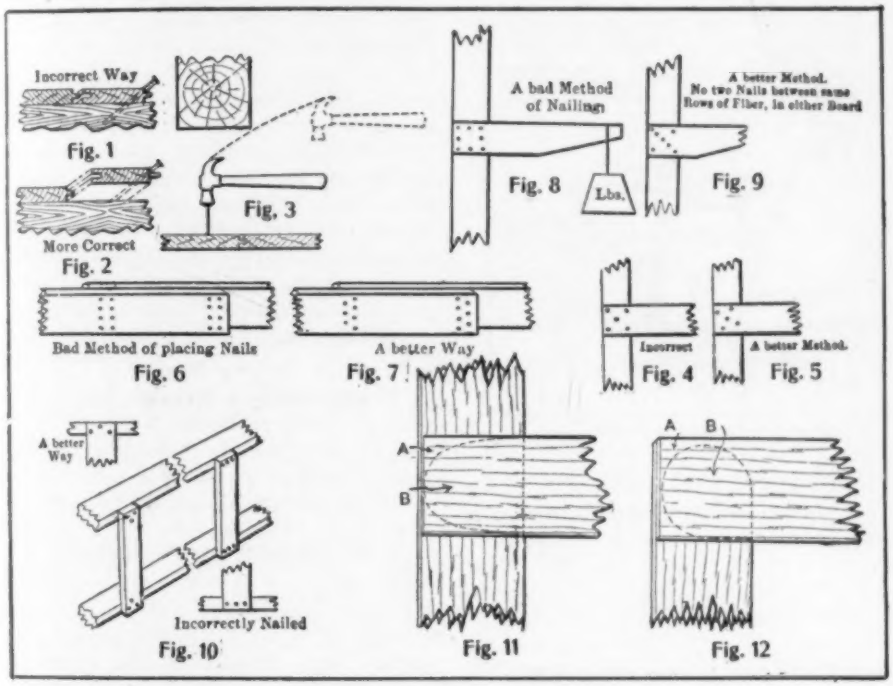
THE PROPER USE OF NAILS

One of the simplest details in correctly driving a nail is almost ignored by the ordinary workman. When a flooring or sheathing board is drawn in place the nail is set slanting and driven as shown in Fig. 1. If the board be lifted from the support about $\frac{3}{4}$ in., drive the nail through until it strikes the studding or joist, then finish driving the nail, taking along with it the board, as in Fig. 2, and the results are much better, says a correspondent in Wood Craft.

To drive a nail in a confined place where a full swing of the hammer cannot be obtained the full force of the hammer can be obtained by moving the arm ahead at the time the blow is being struck, as in Fig. 3.

The location of nails should be placed staggered or zigzag, so as to be out of the line of the same fiber of wood. The illustrations Figs. 4 to 10 show some examples of incorrect nailing and some methods that are more nearly correct.

Another point in locating the position for the nails, especially near the end of boards, is this: It should be remembered that the danger of splitting the board is limited to a well-defined field, the extent of which varies with different kinds of wood, but the general shape is about the same as indicated by the dotted line in Fig. 11, which is supposed in this case to apply to a board 1 in. or less in thickness. A represents the area of risk, B the field of safety—so far as the splitting of the board is concerned. Fig. 12 shows a variation to fit another condition.

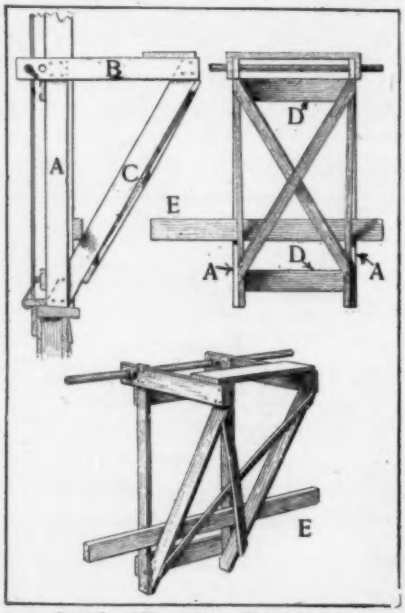


Advantageous Locating of Nails

Probably the heaviest chain ever made has been turned out by an English firm for the Japanese government. The common links weigh 200 lb. apiece, and the end link 300 lb.

A Home-Made Tinsmith's Window Jack

A window jack which can be used for a variety of purposes may be made at small expense by any mechanic. The



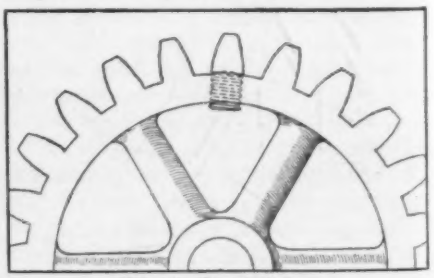
Details of Tinsmith's Window Jack

entire jack is built of strips of 1 in. by 4 in. wood and when completed it has strength enough to hold any reasonable weight, says The Metal Worker. The seat is made of 1 in. by 12 in. board 2 or 3 ft. long. The upright pieces, A, are 4 ft. long and may be left wide enough at the bottom for a notch to prevent slipping in too far on the window sill. The horizontal piece, B, is cut about 3 ft. long and should extend beyond A, with holes bored to receive a piece of ¾-in. gas pipe. The pieces C form the brace to which are nailed two strips of 1 in. by 2 in. material crossed. These strips will keep the jack from twisting. The pieces D are cut about 2 ft. long, but can be any length to suit the width of the jack. A loose piece of 2 in. by 4 in. material 2½ or 3 ft. long is used at the bottom to keep the jack from slipping in on the window sill.

As the jack is light, it is easily carried to the window and attached by setting the foot of the jack on the window sill and running the piece of gas pipe through the holes, so as to prevent it from falling out of the window. The loose piece of 2 in. by 4 in. material is then placed, as shown, across the window, so that the foot of the jack cannot slip in at the bottom. The weight of the jack will then hold it in position and it is a simple matter to climb out on the seat so that a tinner may flash around the top of a window or put in a new window head if desired. Two of these jacks extending out of two different windows with a plank across offer a very good scaffold for mounting a cornice or similar work. To avoid the use of the loose piece at the bottom the side pieces may be made 8 in. wide, notching the bottom 3 or more inches in from front to back and at least 4 in. deep to let the foot of the jack catch the window sill and to prevent it from slipping into the building at the bottom.

Repairing a Broken Cog

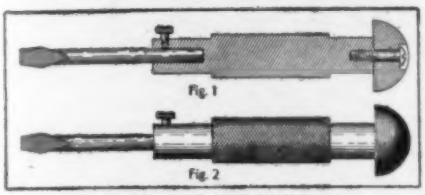
A cog in the main drive gear on our concrete mixer broke at a time when we could not afford to shut down, and as we were 70 miles from the shop, we made the repairs in a short time by threading two ¾-in. holes in the gear at the point where cog was broken and screwed in two steel bolts, riveted the bottoms and dressed up the bolts as shown in the cut. This worked nicely until a new gear could be made, which was several weeks.—Contributed by Frank L. Cash, Haralson, Ga.



Showing Repaired Cog

A Handy Tool Holder

A handy light tool or screwdriver holder may be turned up from a piece of cold rolled steel. It is turned to the shape as shown in the cross section, Fig. 1, with a hole drilled in one end to insert different tools, while the other end is drilled, tapped and fitted with a

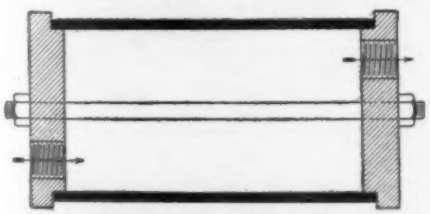


Turned from Cold Rolled Steel

screw which holds a rounded fiber handle loosely. The center part of the holder is knurled as in Fig. 2 and filled with a thumb screw to hold the tools.—Contributed by Frank Schwab, Geneva, N. Y.

Excellent Home-Made Muffler

The illustration shows a muffler for marine gasoline motors that has given great satisfaction. For 3 or 4 hp. it is made of a piece of 5-in. iron pipe, 12 in. long, with cast-iron heads. A bolt

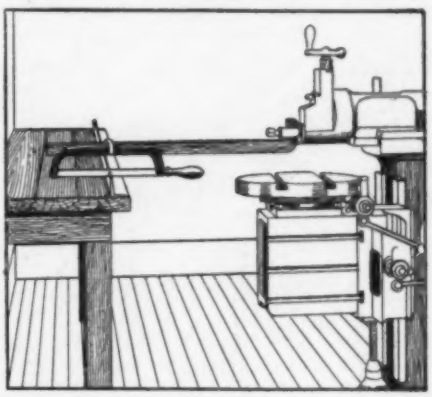


Muffler for Marine Gasoline Motors

running through the muffler holds these heads in place. The inside of this device is filled with old wire. Part of an old woven wire mattress makes an ideal filler. If there seems to be back pressure when the engine is running some of the wire may be removed, until the muffler is adjusted to get the best work out of the engine. Water may be pumped through the muffler if desired, in which case the amount of wire filler can be greatly reduced. It has been found very satisfactory to make the outlet one size larger pipe than that through which the burned gases enter.—Contributed by "Boston."

Substituting a Shaper for a Power Hack-Saw

Where a number of angle irons had to be cut with a hack-saw and there was no power hack-saw in the shop, a shaper was used in its place. A bar of metal, long enough to reach the bench and turned in the shape of an L at one end, which was fitted in the tool post of the shaper, and a hand hack-saw clamped to



Substituting Shaper for Power Hack-Saw

the other end completed the arrangement. The angle iron was clamped to the bench at the right place and the shaper put in action. The bar of metal furnished the weight for the hack-saw to make the cut.—Contributed by C. F. H.

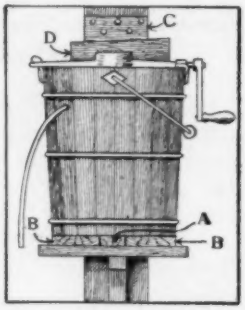
Cleaning Hot Brass

For cleaning hot brass cylinder heads and jackets try the following recipe, which a correspondent of the Practical Engineer says works fine:

Sift coal ashes fine and mix with kerosene oil to a thick paste; add as much air-slaked lime as can be conveniently mixed with it. Apply this polish to the bright parts, rubbing hard; wipe off and polish with dry slaked lime.

A Handy Ice Cream Freezer Shelf

Fasten a shelf, large enough for an ice cream freezer, the right height to a post or wall. On the surface of the shelf nail a cleat, A. Fasten two pieces of wood, BB, the same thickness as the cleat on the bottom of the freezer, leaving space enough between them to allow the cleat to fit in it. The cleat will prevent rotation and movement of the freezer on the shelf. On the post or wall above the rim of the freezer nail another cleat, C. The freezer is then held firmly in position by the wedge, D.—Contributed by James H. Beebee, Rochester, N. Y.



To Keep Dirt from Sticking to a Shovel

Working on the levees in the rice fields, I had a good deal of trouble from the dirt sticking to the shovel. I drilled four small holes through the shovel,

Dirt Will not Stick to This Shovel

which made the shovel self-cleaning.—Contributed by William L. Walker, St. Charles, Ark.

A New Method of Putting Out a Fire

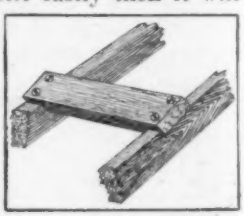
I was alone and a fire started in the roof of my house. There was no ladder at hand and it was too far to throw the water. I filled some corn cans with water and threw them one at a time on the spot where the fire was burning. The empty cans would roll down to be filled again. The location of the fire necessitated my throwing the cans against the wind. In this way I put out a fire that covered 10 sq. ft. in the center of the roof.—Contributed by Sim Harris, Boonville, Colo.

Repairing a Water Closet Trap Valve

Take down the box and disconnect the ball and rod from the plunger by removing the screw. Take out the plunger and put a little machine oil on the top of it and sprinkle with some fine emery. Turn the plunger over and drop into valve. As the plunger and valve are turned work a true bearing is made on the seat. Put a screwdriver into the screw that holds the disk and turn back and forth until a good seat is formed on the valve. Clean out the emery and put on a new disk and you have practically a new valve.—Contributed by William King, Cleveland, O.

A New Kink in Ladder Making

If the rungs of a ladder are made of wood that will split easily then it will be necessary to bore small holes for the nails or screws. To prevent the rungs from splitting when a heavy person mounts the ladder a slanting notch is sawed where each one is fitted, as shown in the sketch. This will make it very light and strong.—Contributed by J. M. Myers, Davenport, Wash.

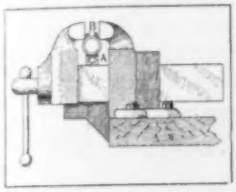


Melting Copper

It is important that none of the copper to be melted should project above the charcoal. Any copper not covered by charcoal will be oxidized or "burnt," and the casting will be weak and full of holes.

Utility Pipe Vise

Here is a kink that shows how a common vise will hold a pipe when other ways fail. An old nut or piece of iron of the right size is placed in the vise at A, which will keep the pipe in position so that the corners of the jaws, B, will close on the pipe. This will not rough up the pipe as when a pipe vise is used.—Contributed by Willis Ferguson, Pisgah Forest, N. C.



To Assist in Making Forgings and Welds

Direct a jet of compressed air against the heated ends of the work. The air blast will cause a display of fireworks and will considerably raise the temperature of the metal just prior to making the forging or weld. By this means it is possible to revive the heat in a piece that has become cooled. The air jet will also blow off all dirt and scale. Try it on a bar of metal and see how it works, says Electric Traction Weekly. It will burn the metal faster, but it will increase the heat.

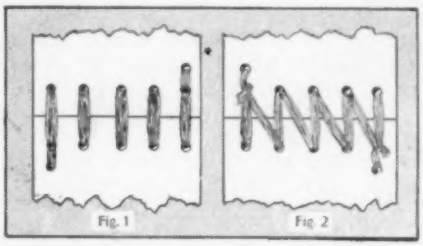
A Three-Horse Evener for Use without a Tongue

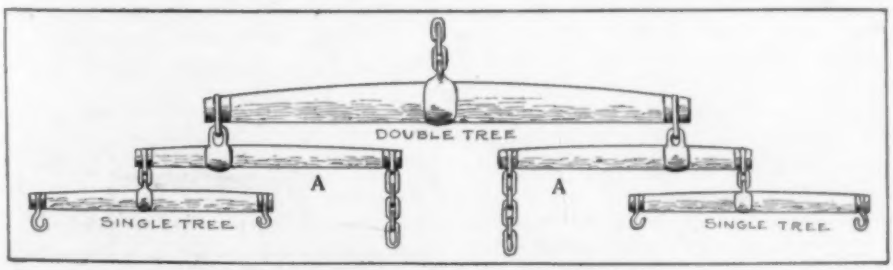
The accompanying sketch shows a three-horse evener for use on a plow or harrow where there is no tongue. The principle is the same as the one previously described in these pages, but this plan makes a lighter evener and has less rigging. The equalizers as shown at A are of ⅝-in. by ¾-in. iron about 18 in. long, with the holes punched one-third of the distance from the ends. An old singletree iron welded on the long end will be strong enough. On the short end a heavier hook is needed and this is supplied by a small clevis and a ring for the middle of the singletrees.

This arrangement can be attached to any two-horse whiffletrees in a few minutes, says a correspondent in The American Blacksmith. By using this plan and crossing the traces the inside horse will have plenty of room without chafing his legs on the traces.

Picture Wire for Belt Lacing

The accompanying sketch shows a novel way of using a picture wire for a belt lacing. A 2-in. belt laced in this manner and running over a 24-in. wood pulley and a 6-in. iron pulley where the speed of the former is 247 r. p. m. has been in service for several months with best results. Fig. 1 shows the outside of the lacing and Fig. 2 the inside.—Contributed by J. E. Morris, Columbus, O.

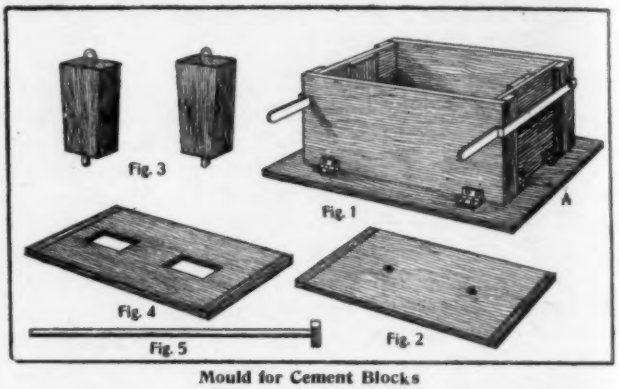




Three-Horse Evener where no Tongue is Used

A Home-Made Cement Block Mould

The lumber necessary to make this mould should be of selected white pine or hardwood free from knots and sap. The base board, A, Fig. 1, should be 14 in. wide by 24 in. long, well battened together. The sides are made as shown with a cleat on each end, which overlaps the end pieces and holds them in place. Both the ends and sides are fastened to the base with hinges, which permit them to be turned down to take out the completed block. On each end is placed a flat iron bar with a bend or notch in it to hold the sides together. These bars are the same as hooks with the ends extended to form a handle for convenience. The end pieces have a thin piece of board fastened in an upright position on their inner surface to form a key between the completed blocks.



Mould for Cement Blocks

The bottom board, Fig. 2, is to be fitted in the bottom of the mould loosely and can be blocked up from the bottom to make the right size block.

The plugs, Fig. 3, are made with a taper on both sides so that in removing them they will clear all the way out. The pins in the bottom of the plugs are to fit in holes in the bottom board, which will hold them in place.

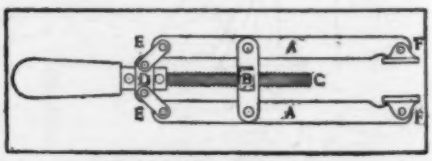
When the plugs are to be removed take the board with the two square holes, Fig. 4, and place over the top of the mould and with the handle of the tamper bar, which is run through the rings in the top of the plugs, lift them upward, using the board as a guard to prevent the block from being broken. This board should not be used until the block is finished and ready to take out of the mould.

The tamper, Fig. 5, is made of a piece of iron rod about 18 in. long with a large nut threaded on one end.

To make the blocks use one part of Portland cement and three parts of good, sharp sand. Mix well and put enough water on to simply dampen the whole mixture. Close up the mould and put in the plugs, and then fill the mould one-quarter full of the mixture and tamp down hard. Repeat this until the mould is filled and then scrape off the surplus material, remove the plugs, turn down the sides and lift out the finished block. The block should remain on the bottom board until it is hard enough to remove. It will be necessary to have a number of bottom boards. The finished blocks must be sprinkled with water from day to day for a duration of 15 to 30 days to properly cure them before using. A barrel of cement will make about 50 blocks.

A Pattern-Maker's Clamp

A very handy clamp for pattern makers' use can be made as shown in the illustration. The device consists of two levers, A, pivoted on the brace, B, which is threaded to receive the clamp screw, C. On this clamp screw is mounted a bushing, D, to which are connected the



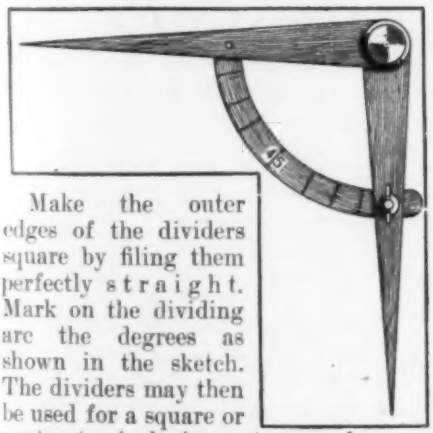
Clamp for Pattern-Makers

links, E. These links, in turn, are connected to the levers, A. The end of the levers are each fitted with a swivel jaw, F. The action of the clamp is readily seen and the clamping pressure is very great on thin work, due to the toggle action of the links.

Cleaning Machinery

Dissolve 1 lb. concentrated lye in about 2 gal. water, and with a mop saturate the engine with the liquid, being careful that it does not get into the oil holes of the journals and bearings. After the lye has eaten all the grease and gum from the surfaces, clean perfectly by scraping and brushing, and after the iron is dry and free from grease, apply a thin coat of lead paint, says Thresherman's Review. After this is thoroughly "set," paint the iron a deep black and varnish heavily. Coloring, striping or decorating should be done before varnishing. Then the engine can be easily and quickly cleaned with a dusting cloth, and escaped oil can be wiped off very easily.

How to Use Dividers for a Square

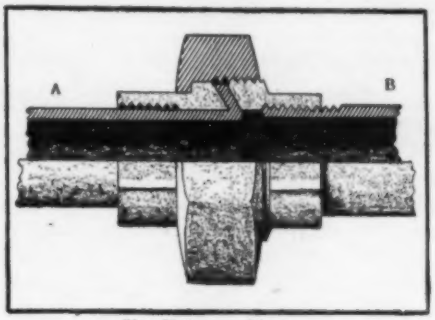


Make the outer edges of the dividers square by filing them perfectly straight. Mark on the dividing arc the degrees as shown in the sketch. The dividers may then be used for a square or protractor in laying out an angle.

Dusting finely ground emery upon paper or cloth that is coated with a thin glue makes emery paper and cloth.

Connecting Iron Pipe to Lead Pipe

Should it be necessary to repair a lead pipe and the tools for making a wiped joint are not at hand, or where



Use Union as Shown

an iron pipe must be attached to a lead pipe, the connection or repair may be made by using a union as shown in the sketch. The union must be of a size that the lead pipe, A, will just slip through the threads. After the parts of the union are on the lead pipe the latter is belled out, forming a flange. This flange makes the gasket for the union. The iron pipe, B, is screwed in to the other part of the union and the connection is made as shown.—Contributed by Alexander A. Gallich, Chicago.

Home-Made Cableway

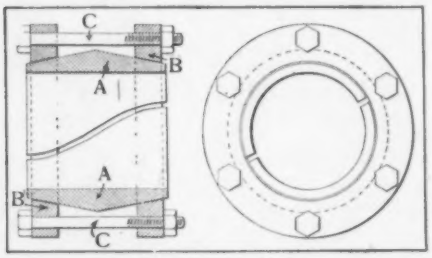
The embankment on a railroad at a certain place was 70 ft. high and in building the concrete culvert through it at the base all materials had to be lowered from the tracks above, says Engineering-Contracting. A cableway was constructed by using a wire rope that passed through a double block at the top, attached to a post sunk in the embankment, the lower end of the rope being attached to another post at the site of the work. On this rope ran two boxes, having deep drop bottoms, and hung from the cables by small snatch blocks. These boxes were fastened to the cable by a 1¼-in. rope in such a way that when one box was at the top

the other would be over the mixing board at the bottom. When the loaded box descended it pulled up the empty one. The speed was controlled by a brake stick.

How to Make a Commutator Press

A press is necessary in the building and rebuilding of commutators to firmly press the segments together so as to hold the mica securely and prevent oil and dust from getting between the segments, says Electric Railway Review. A home-made press can be cheaply made in almost any small repair shop, as shown in the sketch.

The press consists of a diagonally split steel shell, A, tapered toward both ends, the slope being about one in ten. The inside diameter of the shell is just a little larger than the diameter of the assembled commutator which it is desired to press together. Two heavy steel rings, BB, fitting the shell, A, can be drawn together by means of six or eight bolts, CC. The force with which the segments and mica can be pressed together is only limited by the strength of the rings, BB, which are made exceptionally heavy.

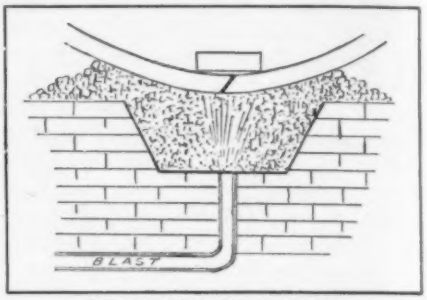


Plan and Section

The bolts CC and the rings BB are removed and one of the rings and the shell A are slipped over the assembled commutator bars and mica. The rings are then put in place and the bolts uniformly tightened. When sufficiently tight the whole can be put in a lathe and the commutator bars can be bored out true to receive the commutator shell and its insulation. When this insulation has been properly placed in position, the clamping ring is warmed and put on over the end insulating ring and the bolts tightened. The clamp can now be removed and the assembled commutator placed in a lathe and the face turned.

Welding Wide Tires

Give the tire the right lap without scarfing. Heat it red hot and clip off the edges with a sharp chisel. This is a



"Start with a Steady Blast"

great deal quicker and better than scarfing with a fuller, says the American Blacksmith. Stand the tire up in the fire and place a fire brick on top of the scarfs. A common building brick will do as well, only it does not last as long as the fire brick. Start with a steady blast, and if you find the edges getting hot before the center, stop the blast a few moments until it shows the same heat all over, and then blow up again and you will get a good heat. Any wide iron can be welded in this way in one heat if there are two good hammermen that know their work. Let the edges spread out as much as they will and trim with a chisel. The main point is, do not hurry. Give a steady blast and do not force it; coax it.

To Drill Tempered Steel

Sometimes it is necessary to drill out parts of a broken tap which is hard to make a drill take hold of it. Keep the drill and steel wet with spirits of turpentine and the drill will bite, where at other times it would wear the cutting edge.—Contributed by Wm. Rosenblohm, Brooklyn, N. Y.

A Ladder Made of Gas Pipe

A light and durable ladder can be made of ordinary gas pipe and fittings, as shown in Fig. 1. Use about 1-in. gas pipe with T connections. In putting it together some of the connections will need to have right and left threads. It would be well to use the rungs for this and have right and left threads on them. This will not make a heavy ladder and is lighter than some of the usual wooden ones, and is, of course, fireproof.

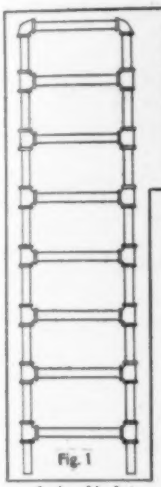


Fig. 1

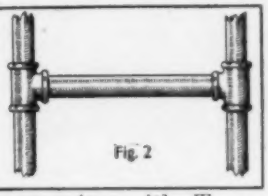
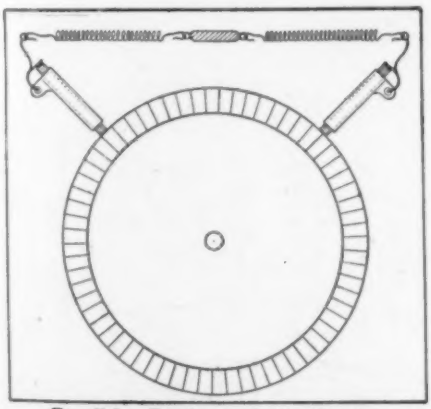


Fig. 2

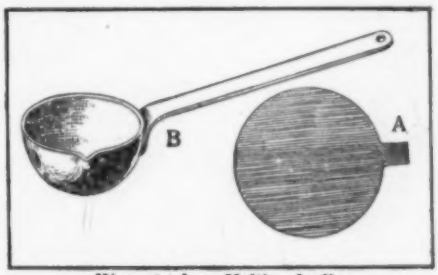
Equalizing Brush-Holder Springs

Many commutator troubles may be overcome by equalizing the tension on the brush-holder springs, says a correspondent in Electric Traction Weekly. Connect the brushes in pairs, as shown in the sketch, by small coil springs, which will keep the tension on the two sets of brushes balanced and equalized. A small insulator should be placed in between the springs. This reduces the wear on the commutator and brushes, and will do away with grooves, rough places and burnt spots.


Equalizing Tension on Carbon Brushes

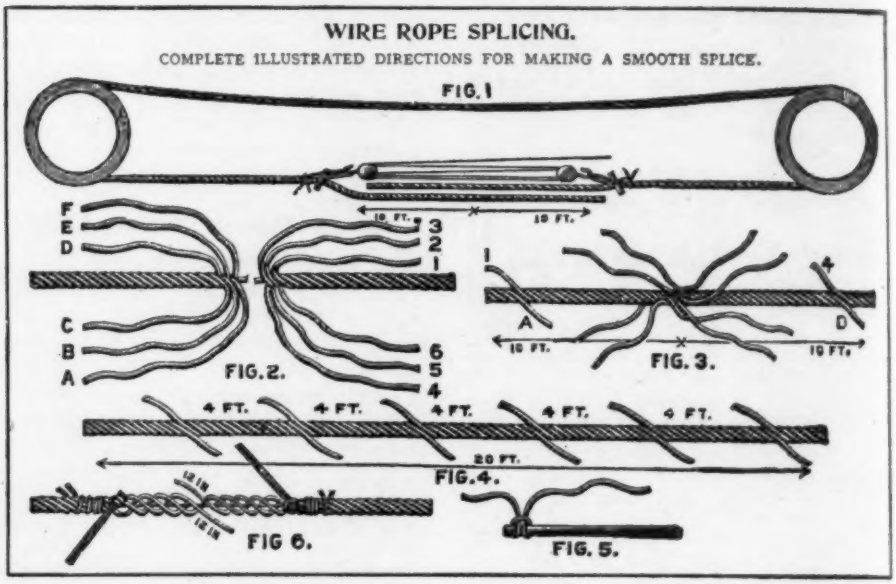
How to Make a Melting Ladle

A ladle for melting lead or babbitt metal that is made of wrought iron will not break like one made of cast iron, says a correspondent in The American Blacksmith. A wrought iron ladle can be made by cutting a piece of flat iron or steel in the shape as shown in sketch at A from about ¼-in. thick material. Weld or rivet a handle to this piece. Take a wide band about 1½ in. smaller than the piece cut for the ladle. If you do not have a band of this description, make one. Heat the piece from which you intend to make the ladle until it is red hot. Take a round-faced hand hammer, lay the flat piece on the band, and hammer it down until you have it in the shape of a ladle. It may take several heats to do this, for it all depends on the size of the ladle. When completed it should be in the shape as shown at B.



Wrought-Iron Melting Ladle

A cement that will resist white heat may be made of pulverized fire clay, 4 parts; plumbago, 1 part; iron filings or borings free from oxide, 2 parts; peroxide of manganese, 1 part; borax, ½ part, and sea salt, ½ part. Mix these to a thick paste and use immediately. Heat up gradually when first using.



Wire rope is susceptible of the most perfect splice; a better and smoother splice can be put in a wire rope than in any other kind of rope, for the simple reason that it is made with a view to this purpose. It has just the desired number of strands, namely, six, and a hemp core which provides place for fastening the ends. It is a plain, simple process, and but the work of an hour for anyone to learn.

In cases where an endless rope cannot be put on already spliced, the rope has to be put around the sheaves, hove taut by pulley blocks, and the splice made on the spot. See Fig. 1 in diagram of splices.

The necessary tools are a hammer and sharp cold chisel for cutting off ends of strands; a steel point or marlin spike for opening strands; two slings of tarred rope with sticks (see Fig. 5) for untwisting rope; a pocket knife for cutting the hemp core; a wooden mallet and block.

First—Put rope around the sheaves and heave it *tight* with good block and fall (see Fig. 1). The blocks should be hitched far enough apart so as to give room between to make a 20-ft. splice. A small clamp may be used to prevent the lashing from slipping on the rope where the blocks are hitched (see Fig. 1). Next see that the ropes overlap about 20 ft., about 10 ft. each way from the center, as shown by the double arrow in Fig. 1. Next mark the center on both ropes with a piece of chalk, or by tying on a small string. Now proceed to put in the splice, with the blocks remaining taut, when necessary; but the better way is to remove the blocks, throw off the ropes from the sheaves, let it hang loose on the shafts, and proceed with the splice on the ground or floor, or scaffold, as the case may be.

Second—Unlay the strands of both ends of the rope for a distance of 10 ft. each, or to the center mark, as shown in Fig. 2. Next cut off the hemp cores close up, as shown in Fig. 2, and bring the bunches of strands together, so that the opposite strands will interlock regularly with each other (see Fig. 3).

Third—Unlay any strand, A, and follow it up with strand 1 of the other end, lay it tightly in the open groove made by unwinding A, make twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but 12 in. of 1 are laid in, or till A has become 10 ft. long. Next

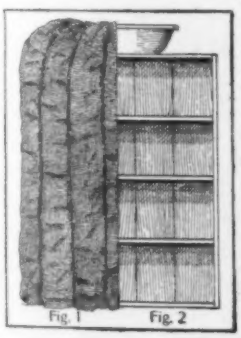
cut off A, leaving an end about 12 in. long.

Fourth—Unlay a strand, 4, of the opposite end, and follow with strand D, laying it into the open groove as before, and treating this precisely as in the first case (see Fig. 3). Next pursue the same course with B and 2, stopping 4 ft. short of the first set. Next with 5 and E, stopping as before. Then with C and 3; and lastly with 6 and F. The strands are now laid in with the ends 4 ft. apart, as shown in Fig. 4.

Fifth and last—The ends must now be secured without enlarging the diameter of the rope. Take two rope slings or twisters (see Fig. 5) and fasten to the rope as shown in Fig. 6; twist them in opposite directions, thus opening the lay of the rope (see Fig. 6). Next, with the knife cut out the hemp core about 12 in. on each side. Now straighten the ends, and slip them into the place occupied by the core, then twist the sling back, closing up the rope, taking out any slight inequality with a wooden mallet. Next shift the slings and repeat the operation at the other five places, and the splice is made.

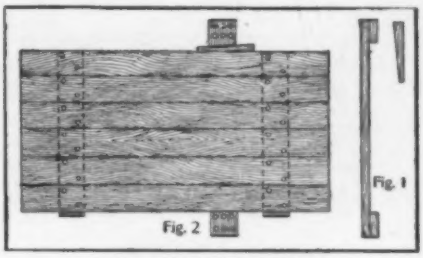
Home-Made Cooler

A cooling device that will keep things cold can be made at little cost and will work well in any place. I have used one that kept food cold, say 55°, on the desert with heat registering by the thermometer 115° to 120°. The frame may be made as high as you wish and to hold the required number of shelves, as shown in Fig. 2 Cover this over on all sides with burlap as shown in Fig. 1, leaving a part of the upper end of the burlap to lay in a pan of water which is placed on top of the frame. The burlap will absorb the water, which will run down the sides, keeping the enclosed contents cool. It is necessary to change the water every morning.—Contributed by H. C. Mayer, Venice, Cal.



Quickly Made Carpenter's Clamp

This is a handy device if anyone has a door to make or any cabinet work where tools are scarce. Take a board of sufficient length and nail a cleat on both ends, as shown in Fig. 1. The space between the cleats should be of a width that will just take in the door or cabinet work. The wedge is then driven in as shown in Fig. 2, which holds the boards together until they are nailed to the batten pieces or glued in cabinet work.



Clamp for Cabinet Work

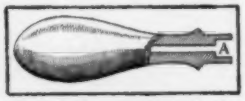
Annealing Novo Steel

If you have a piece of novo high speed steel and wish to soften it so it can be worked, take a barrel of slacked lime, and a piece of gaspipe about an inch larger in diameter and two or three inches longer than the steel you wish to anneal. Thread the pipe on both ends and fit a cap on one end, then put in about an inch of lime, drop in the steel and pack well with lime, keeping the steel in the middle of the pipe, and fill the other cap with lime and screw it on the other end. Put the pipe and its contents in the fire and heat slowly and evenly to a white, but not melting, heat and then take it out and quickly bury it in the middle of your barrel of lime and leave

it for 12 or 14 hours. For ordinary sized pieces the time taken to heat will not be over 20 minutes and if a good sized forge is used, it will be considerably less. Be sure it is heated through before putting it in the lime barrel.—Contributed by E. V.

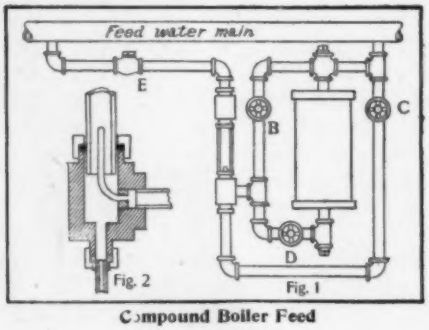
Wood Handle Without a Metal Ferrule

Make the handle the shape desired and bore a ½-in. hole about ½ in. deep in the end where the tool is to be inserted. Continue the hole to the required depth with a ¼-in. bit or drill. The rim of the larger hole, A, as shown in the sketch, serves as a ferrule and will keep the wood handle from splitting.—Contributed by W. C. Loy, Rochester, Ind.



How to Make a Boiler Compound Feeder

The accompanying sketch shows a type of boiler compound feeder which depends for its action on the drop in pressure between two points in the feed water main to which it is connected, being evident that the greater the distance apart the points of connection are made the greater will be the tendency of the flow of feed water to follow the path offered through the feeder. The arrangement has the advantage of increasing the rate or amount of compound feeding to the boilers when the feed water being delivered to the boiler is increased and *vice versa*, which tends to give automatic control within certain limits.



Compound Boiler Feed

The difficulty of securing sight feed in handling boiler compounds has been overcome in this feeder in an ingenious manner and constitutes the improvement for which originality is claimed. Referring to the sketch, it will be seen that opening the valve C admits a flow of water which passes around the feeder and up through the glass, giving an independent circulation that maintains a clear view of the jet from which the boiler compound is flowing. The action prevents any coloring matter, used in mixing the compound, from diffusing, as the rapid circulation carries it beyond the jet before it has had time to blend with the circulating water.

The usual soda compounds are made more effective when a small quantity of tannic acid is used, as results from adding logwood during the period of dissolving the soda crystals, giving the solution a dark amber color that when feeding gives the appearance of a miniature column of smoke issuing from the jet. A mixture of this character will be heavier than water and should be fed from the bottom through valve D. A compound lighter than water may be fed equally as well by closing valve D and opening valve B.

The use of the check valve E is for the purpose of retarding the rebound of the water, due to the pump action, which would otherwise cause the water to surge in the glass, preventing a steady feed.

Fig. 2 shows an enlarged cross-section of the part where the compound comes in contact with the feed water.—Contributed by C. Everett Smith, Baltimore, Md.

In treatment of burns the main thing is exclusion of air and keeping the skin soft with some unguent. White of eggs beaten while castor oil is poured in until a thick creamy paste is formed makes a good application which is easily prepared.

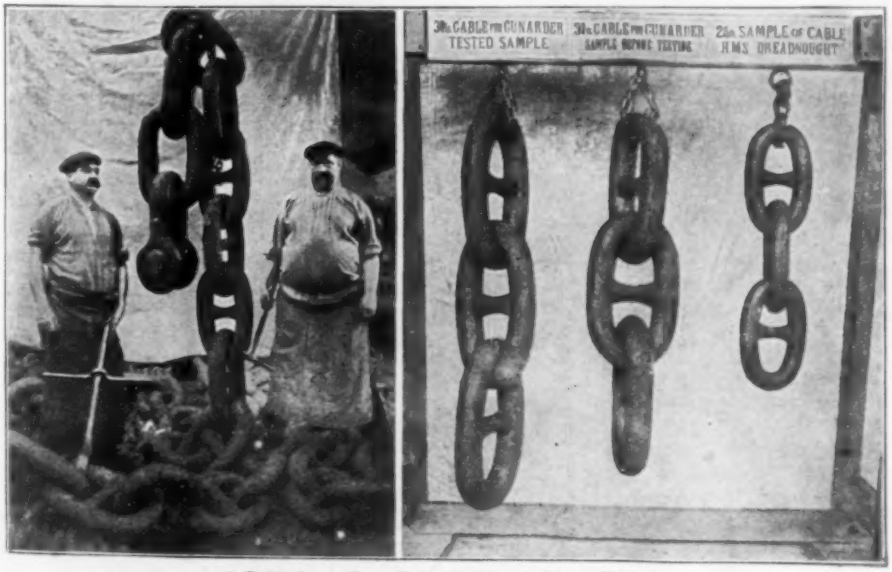
GREAT CHAINS FOR SHIPS

For mooring the "Lusitania" and "Mauretania" in the River Mersey 12-ton anchors are used and the mooring weighs over 200 tons. The four bridle chains are 750 ft. long. Square links are used in the construction of the main chain, each weighing 400 lb., and measuring 4 ft. in length. The swivel connection for the bridle chains weighs 4,485 lb., and the shackles 711 lb. each. The buoy pendant is constructed of iron $4\frac{1}{4}$ and $5\frac{3}{8}$ in. in diameter.

These links were tested to destruction by a powerful machine built to test chains of the largest size. Each link elongated $\frac{1}{4}$ in., under the Admiralty proof strain of 198.8 tons. There was a further stretching of $\frac{3}{4}$ in., when the statutory breaking stress of 267.7 tons was applied. The links then stood a test of over 370 tons actual tension without breaking, the full power of the testing machine. Although the strain was above the Admiralty proof stress by nearly 100 tons no defect or sign of fracture was noted. These chains were constructed at Pontypridd, Eng., by the British Admiralty contractors.

12-Ton Anchor

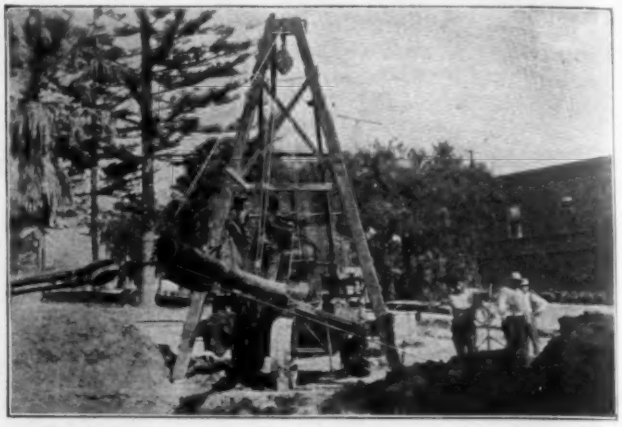
The cables of the "Dreadnought," although the largest battleship afloat, are much smaller, the metal being only $2\frac{1}{16}$ in. in diameter. The accompanying illustrations show the construction and size of the "Mauretania's" cable links compared with the height of a man.



A Pull of 370 Tons Failed to Break These Chains

BACK-FILLING WITH PORTABLE ENGINE

This machine is a mechanical jack of all trades. At the time the photograph was taken it was engaged on a contract for back-filling a ditch 10 ft. deep, 8 ft. wide and 3,000 ft. long. The portable plant includes an upright boiler and 15-hp. engine. It has a traction drive for propelling itself, and several winding drums, a derrick and boom.



Economical Method of Filling

On this particular job the boom reaches across the deep ditch immediately in front. The rope to the left holds the boom in place, while a small wire rope pulls the scraper containing about ¼ yd., into the ditch. Another small wire rope, running through the pulley at the curb back of the last man, pulls the scraper back again. It goes much quicker than it takes to tell. The arrangement is the idea of a contractor in California where the machine is in use.

SOUND SHADOWS IN FOG DANGEROUS TO NAVIGATION

Repeated experiments by the government have proven that sound in fog is erratic, and that mariners run a grave peril when they trust to fog signals alone when navigating dangerous coasts.

The reason for this ungentlemanly behavior of sound is designated as "sound shadows," within which the ear detects no trace of the signal, although the whistle may be blowing continuously, and the sound perfectly audible on all sides of the shadow.

Sound Waves Ricochet

In many instances the cause of a sound shadow can easily be discovered. The existence of a bluff behind the whistle sometimes makes the sound waves ricochet in a bounding manner over the water, perfectly audible at say one mile, inaudible at two miles, and distinctly heard again at three miles. It is impossible to trace the origin of many sound shadows because they are doubtless due to some peculiar condition of the atmosphere.

LONG-DISTANCE CONTROL OF MECHANISM

The control at a distance of death-dealing machines of war, such as mines and torpedoes, may become practical, if the work of inventors on an ingenious system of controlling mechanisms by wireless bears fruit.

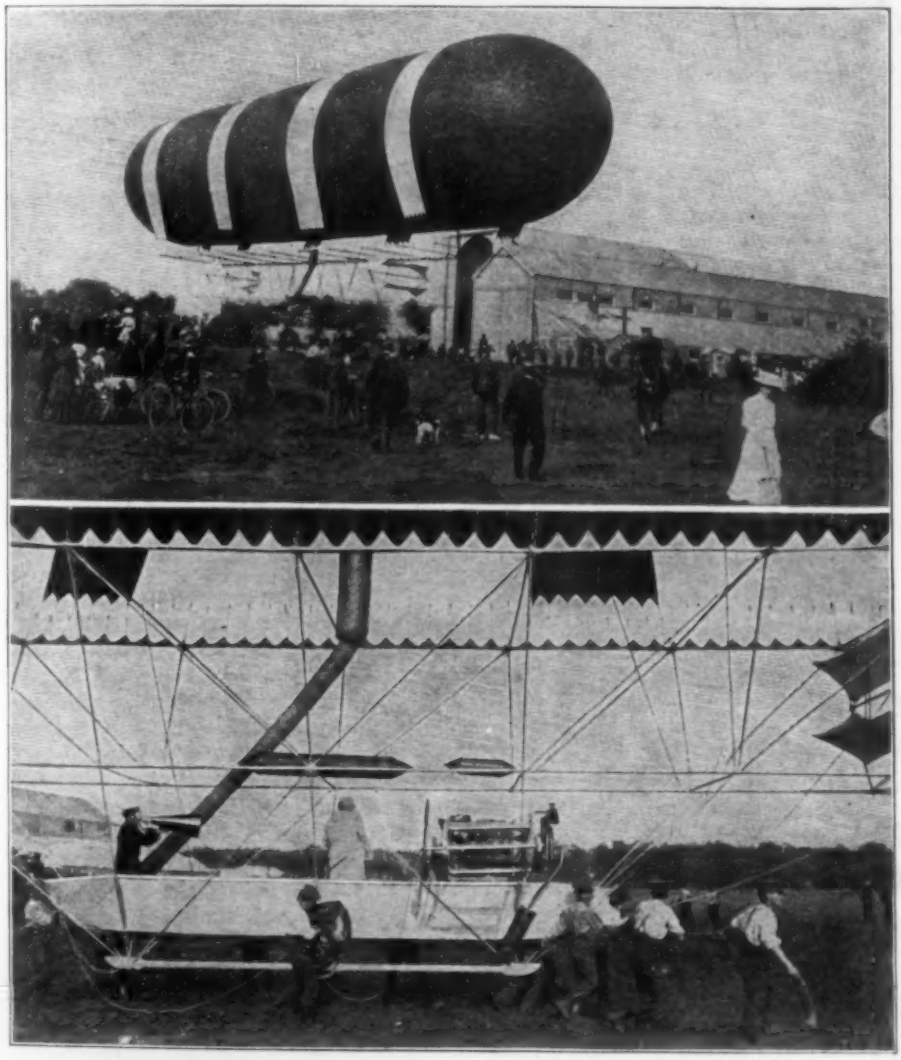
A demonstration has been given which proves that any number of actions can be controlled but not perfectly, because only one action can be controlled at a time. This is accomplished by driving two series of distributing switches in synchronism, one at the control station and the other at the station where the controlled mechanisms are. The switch at the receiving sta-

tion closes one after the other of the circuits controlling different actions. During this period it is possible, by sending an electrical wave from the control station, to close a relay in that particular circuit, which closes the circuit of the local controlling mechanism. An indispensable feature of the system is an automatic return signal given when the mechanism has completed the desired operation.

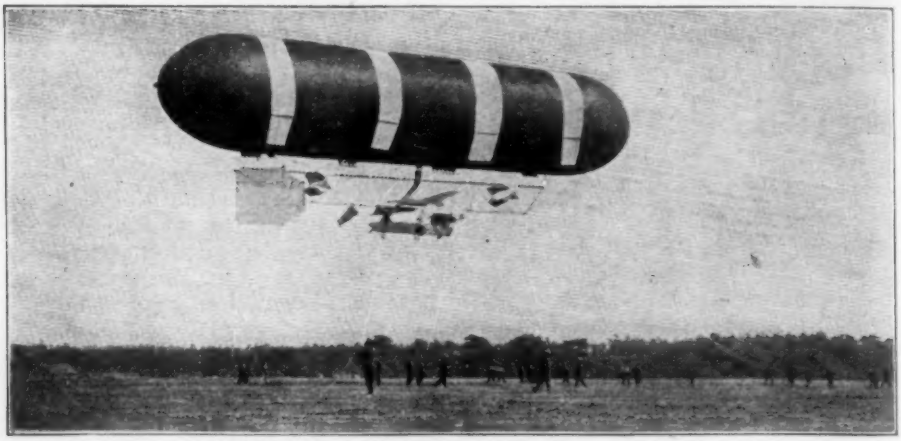
ENGLAND'S FIRST MILITARY AIRSHIP A SUCCESS

Sails Against the Wind—Answers Helm Well—Aerial War Machines Not Immune to Artillery

The recent successes of French and German airships has at last awakened England to the great importance of these weapons of modern warfare, and for the moment her interest has been

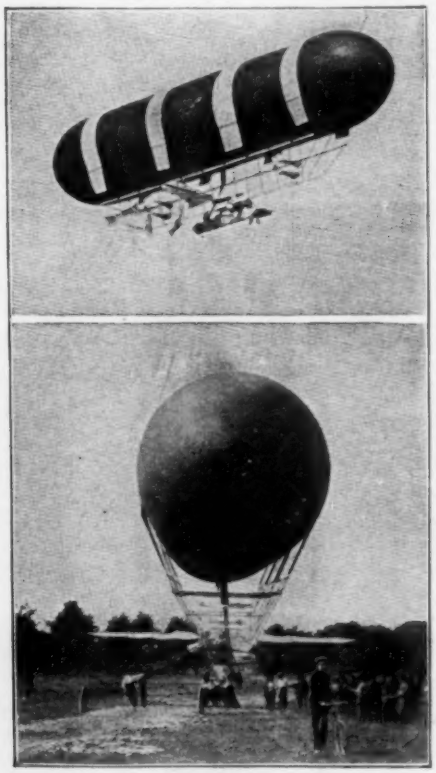


English War Balloon Ready for Flight—Note Pipe Conducting Exhaust Gas to Bag



The Gas Bag is 100 Ft. Long and 30 Ft. in Diameter

diverted from "Dreadnoughts" and other mighty marine war machines by the highly successful trials of the first airship ever constructed by the English army.



This Ship Can Raise One Ton

Two trials have been made in which the airship has proved itself capable of being handled easily with or against the wind, and to answer its helm satisfactorily. In the second trial a semicircle of two miles was navigated and then an accident occurred to the engine which made it necessary to descend to the ground. The defect was only slight and easily remedied. During the trip the wind blew at a rate of 15 miles an hour, but the airship had no difficulty navigating against it at a speed of 5 miles an hour, rising and falling gently like a vessel in a seaway.

The English airship is a dirigible balloon, 100 ft. long by 30 ft. in diameter and shaped like a sausage. The gasoline for the motors is carried in two torpedo-like cylinders above the car. The exhaust vapor from the engines—a hot gas—is carried up into the balloon by means of a tube, so arranged as to avoid any danger of a spark from the engines entering the immense bag and causing a fatal explosion.

The ship has a lifting capacity of one ton, which, after deducting the weight of the car, engines and other apparatus, permits the carriage of a crew of three men of average size.

An artillery corps on another part of the English isle has been busy learning how to destroy war airships, by knocking holes in balloons three miles distant and 1,200 ft. up in the air.

CONCRETE CONSTRUCTION FOR STOCKYARDS

Reinforced concrete is being rapidly substituted throughout the maze of platforms, chutes and runways at the Chicago stockyards in place of the old woodwork which made that section so liable to fires. An immense platform 1,300 ft. long has just been entirely rebuilt. Electric light wires will be run through tubes imbedded in the concrete, making fire from this source impossible.

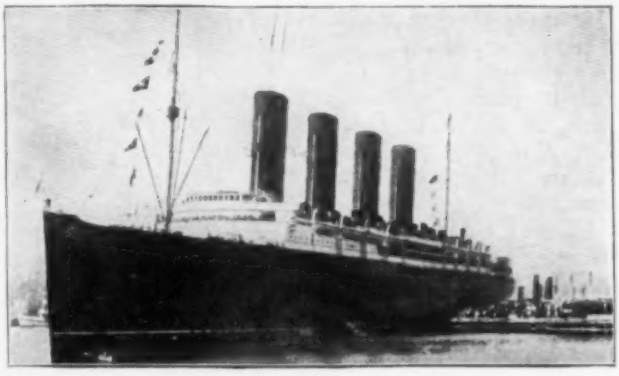
"LUSITANIA" FAILS TO BREAK TRANS-ATLANTIC RECORD ON MAIDEN TRIP

The "Lusitania," queen of the seas, heralded as the greatest ship afloat, has made her maiden voyage. Although she now holds the record between Liverpool and New York, the trans-Atlantic speed laurels still remain with her big German rivals, the "Deutschland" and "Kaiser Wilhelm II."

This mammoth turbine ship, the largest vessel in the world, left Liverpool at 8 o'clock Saturday night, Sept. 7, and arrived off Sandy Hook at 8 o'clock Friday morning, Sept. 13, having reduced the record from Queenstown, which is on the coast of Ireland, by 6 hours, 29 minutes. Her fastest daily run was 593 miles, 8 miles less than the run of 601 miles logged by the "Deutschland." The turbines worked to perfection, not the merest accident marring the voyage.

Despite the fact that the turbine ship has not wrested all the speed records of the sea from her older rivals, it was generally admitted that her performance was remarkable for a maiden voyage and that she will develop speed enough, when her engines are thoroughly tried out, to carry everything before her. To do this she must establish a record of more than 23 miles an hour on the westward trip, held by the "Deutschland," and more than 23 miles an hour on eastward trip, held by the "Kaiser Wilhelm II."

CURIOUS FRENCH AMBULANCE.—This picture was taken under fire during one of the battles before Casa Bianca for the Illustrated London News. It shows the type of field ambulance, accommodating two men. In this instance the near pannier contains a wounded Legionary, while the off pannier holds the body of a dead soldier.



"Lusitania" at New York, Sept. 13

The management of the Chicago and Northwestern Railroad is experimenting with a German speedometer, placed in one of the cars instead of on the engine, which not only records the speed the train makes, but also records all stops and their duration. The purpose of the new speedometer is to educate engineers to try for smoother runs and also to incite train and station crews to faster work at stations.

Amateur Mechanics

HOW TO MAKE SILHOUETTES

Photography in all branches is truly a most absorbing occupation. Each of us who has a camera is constantly experimenting, and every one of us is delighted when something new is suggested for such experiments.

To use a camera in making silhouettes select a window facing north if possible, or if used only at times when the sun is not on it, any window will do, says the Photographic Times. Raise the window shade half way, remove any white curtains there may be, and in the center of the lower pane of glass paste by the four corners a sheet of tissue paper that is perfectly smooth and quite thick, as shown in the sketch at B. Darken the rest of the window, shutting out all light from above and the sides.

Place a chair so that after being seated the head of the subject will come before the center of the tissue paper, and near to it as possible, and when looking straight before him his face will be in clear profile to the camera.

Draw the shades of all other windows in the room. Focus the camera carefully, getting a sharp outline of the profile on the screen. Do not stop down the lens, as this makes long exposure necessary, and the subject may move.

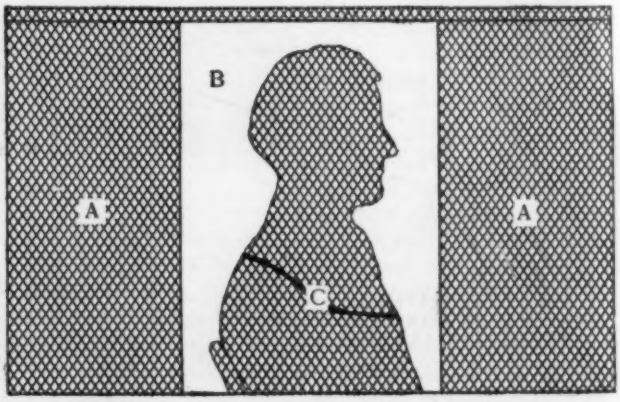
Correct exposure depends, of course, on the lens, light and the plate. But remember that a black and white negative is wanted with as little detail in the features as possible. The best plate to use is a very slow one, or what is called a process plate.

In developing get all possible density in the high lights, without detail in the face, and without fog. Printing is best done on contrasty development paper with developer not too strong.

The ideal silhouette print is a perfectly black profile on a white ground. With a piece of black paper, any shape in stopping off print may be made as shown at C in the sketch.

HOW TO CROSS A STREAM ON A LOG

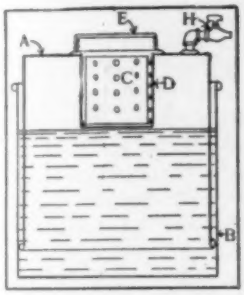
When crossing a water course on a fence rail or small log, do not face up or down the stream and walk sideways, for a wetting is the inevitable result. Instead, fix the eye on the opposite shore and walk steadily



forward. Then if a mishap comes you will fall with one leg and arm encircling the bridge.—C. C. S.

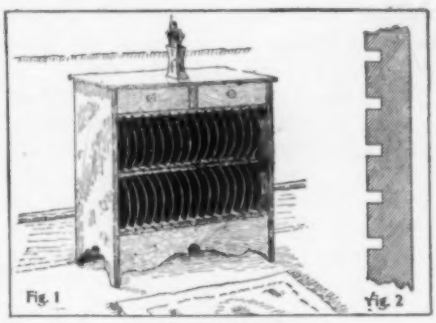
A HOME-MADE ACETYLENE GAS GENERATOR

A simple acetylene gas generator used by myself for several years when out on camping trips was made of a galvanized iron tank, without a head, 18 in. in diameter and 30 in. deep, B, as shown in the sketch. Another tank, A, is made the same depth as B, but its diameter is a little smaller, so that inverted it will just slip easily into the tank B. In the bottom, or rather the top now, of tank A is cut a hole and a little can, D, is fitted in it and soldered. On top and over can D is soldered a large tin can screw. A rubber washer is fitted on this so that when the screw top, E, is turned on it, the joint will be gas-tight. Another can, C, which will just slip inside of the little can, is perforated with a number of holes. This can C is filled about half full of broken pieces of carbide and then placed in the little can D. A gas cock, H, is soldered on to tank A, as is shown, from which the gas may be taken through a rubber tube. Fill tank B with water and set tank A into it. This will cause some air to be inclosed, which can be released by leaving the cock open until tank A settles down to the point where the water will begin to run in the perforations of the little tank. The water then comes in contact with the carbide and forms gas, which expands and stops the lowering of tank A. Then the cock must be closed and tubing attached. It is dangerous to attempt to strike a match to light a jet or the end of the cock while air is escaping and just as the first gas is being made. Wait until the tank is well raised up before doing this.—Contributed by James E. Noble, Toronto, Ont.



HOME-MADE DISC RECORD CABINET

Select some boards that have a nice grain that are about 1 in. thick and 12 in. wide. Cut the end pieces each 36 in. long and trim down the edges so as to make them 11⅜ in. wide. The top board is made 28 in. long and full 12 in. wide. The three shelves are cut 25 in. long and the edges trimmed so they will be 11⅜ in. wide. The distance between the bottom of the top board and the top of the first shelf should be 3 in. Two drawers are fitted in this space as shown in Fig. 1. A series of grooves are cut ¼ in. wide, ¼ in. deep and ¾ in. apart on one side of the top and bottom shelves, as shown in Fig. 2, and on both sides of the middle shelf. The shelves should be spaced 9⅝ in. for 10-in. records and 5⅝ in. for 6-in. records. A neat scroll design is



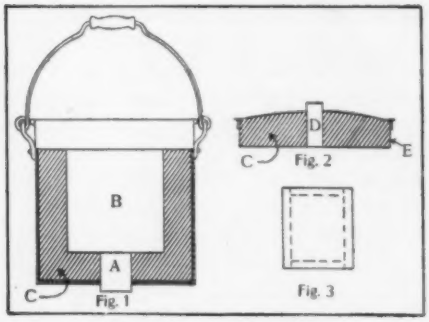
Holds 32 Records

cut from a board 25 in. long to fill up and finish the space below the bottom shelf.—Contributed by H. E. Mangold, Compton, Cal.

HOME-MADE POTTERY KILN

A small kiln for baking clay figures may be built at a cost of $1. The following shows the general plan of such a kiln which has stood the test of 200 firings, and which is good for any work requiring less than 1400° C.

Get an iron pail about 1 ft. high by 1 ft. across, with a cover. Any old pail which is thick enough will do, while a new one will cost about 80



Home-Made Pottery Kiln

cents. In the bottom of this cut a 2-in. round hole and close it with a cork or wood plug, A, Fig. 1, which shall project at least 2 in. inside the pail. Make a cylindrical core of wood, B, Fig. 1, 8 in. long and 8 in. across. Make a mixture of clay, 60%; sand, 15%; and graphite, 25%, kneading thoroughly in water to a good molding consistency. Line the pail, bottom and sides, with heavy paper and cover the core with same. Now pack the bottom of the pail thoroughly with a 2-in. layer of the clay mixture, and on it set the paper-wrapped core, carefully centering it. The 2 in. of space between the core and the sides of the pail all around is to be filled with clay, C, as is shown in the sketch, using a little at a time and packing it very tight. In like manner make the cover of the kiln, cutting the hole a little smaller, about 1 in. At the edge or rim of the cover encircle a 2-in. strip of sheet iron, E, Fig. 2, to hold the clay mixture, C. Set aside for a few days until well dried.

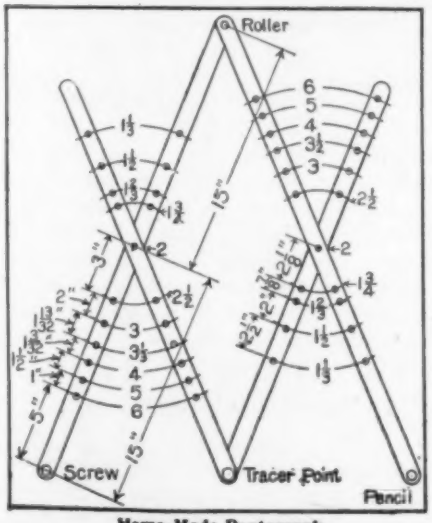
While these are drying you can be making a muffle, if there is to be any glazing done. This is a clay cylinder (Fig. 3) with false top and bottom, in which the pottery to be glazed is protected from any smoke or dust. It is placed inside the kiln, setting on any convenient blocks which will place it midway. The walls of the muffle should be about $\frac{1}{2}$ in. thick, and the dimensions should allow at least 1 in. of space all around for the passage of heat between it and the walls of the kiln. By the time the clay of the kiln is well dried, it will be found that it has all shrunk away from the iron about $\frac{3}{8}$ in. After removing all the paper, pack this space—top, bottom and sides—with moist ground asbestos. If the cover of the pail has no rim, it may be fastened to the asbestos and clay lining by punching a few holes, passing wire nails through and clinching them. Fit all the parts together snugly, take out the plugs in the top and bottom, and your kiln is ready for business. The handle of the pail will be convenient for moving it about, and it can be set on three bricks or some more elaborate support, as dictated by fancy and expense.

The temperature required for baking earthenware is 1250°-1310° C.; hotel china, 1330°; hard porcelain, 1390°-1410°. These temperatures cannot be obtained in the above kiln by means of the ordinary Bunsen burner. It will be necessary either to buy the largest size Bunsen, or make one yourself, if you have the materials. If you can get a cone which can be screwed into an inch pipe, file the opening of the cone to $\frac{1}{16}$ in. diameter, and jacket the whole with a $2\frac{1}{2}$-in. pipe. The flame end of this burner tube should be about $4\frac{1}{2}$ in. above the cone opening and should be covered with gauze to prevent flame from snapping back. When lighted, the point of the blue flame, which is the hottest part, should be just in the hole in the bottom of the kiln. Such a burner will be cheaply made and will furnish a kiln temperature of 1400°, but it will burn a great deal of gas.

A plumber's torch of medium size will cost more in the beginning, but will be cheaper in operation. Whatever burner is used, the firing should be gradual, and with especial caution the first time. By experiment you will find that a higher temperature is obtained by placing a 1-in. pipe 2 ft. long over the lid hole as a chimney. It would be still more effective to get another iron pail, 2 in. wider than the kiln, and get a down draft by inverting it over the kiln at whatever height proves most suitable.—G. L. W.

HOW TO MAKE A PANTOGRAPH

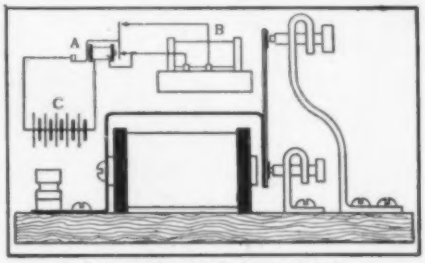
Secure four pieces of wood, from which cut and dress down to $\frac{3}{16}$ in. by $\frac{3}{4}$ in.; make two of them 31 in. long and the other two 24 in. long. These pieces of wood may be of any material, but it is best to make them of some hard wood. The "screw" in the sketch is a screw-eye long enough to pass through the arm and an old silk spool. This will keep the arms up from the board or table so as to allow a point at tracer point and pencil to be a little above the work. At tracer point a round-headed brass wood screw is used which is filed to a point and slightly rounding so it will not scratch. A lead pencil is sharpened and fitted in a hole marked "pencil." At point marked "roller" a screw-eye is put in from underneath to allow a rounding edge for this point to rest. The small holes on all arms are marked on the left from $1\frac{1}{3}$ to 6 and on the right from 6 to $1\frac{1}{3}$. When matched and clamped with a screw-eye will enlarge sketch or pattern from tracer point to the size of holes that are numbered in the semicircle. If holes marked $1\frac{1}{3}$ on left are matched and holes $1\frac{1}{3}$ on right are matched then it will increase the size of the drawing $1\frac{1}{3}$. If No. 6 on the left and No. 6 on the right are matched then the increase will be 6 times. The distance the holes are made one from the other is shown with the figures and inch marks.—Contributed by E. W. Bowen, Denver, Colo.



Home-Made Pantograph

CIRCUIT BREAKER FOR INDUCTION COILS

Amateurs building induction coils are generally bothered by the vibrator contacts blackening, thus giving a high resistance contact, whenever there is any connection made at all. This trouble may be done away with by departing from the old single contact vibrator and using one with self-cleaning contacts as shown. An old bell magnet is rewound full of No. 26 double cotton-covered wire and is mounted upon one end of a piece of thin sheet iron 1 in. by 5 in. as per sketch. To the other end of the strip of iron is soldered a piece of brass 1-64 in. by $\frac{1}{4}$ in. by 2 in., on each end of which has been soldered a patch of platinum foil $\frac{1}{4}$ in. square.



Interrupter for Induction Coil

The whole is connected up and mounted on a baseboard as per sketch, the contact posts being of $\frac{1}{16}$ in. by $\frac{1}{2}$ in. brass, bent into shape and provided with platinum tipped thumb screws. The advantage of this style of an interrupter is that at each stroke there is a wiping effect at the heavy current contact which automatically cleans off any carbon deposit.

In the wiring diagram, A is the circuit breaker; B, the induction coil, and C, the battery.—Contributed by A. G. Ward, Wilkinsburg, Pa.

HOW MEN MAKE BIG SALARIES

By PROSPER WELLES

The Story of Workers Who Make Their Work Pay Big Dividends—Who Wanted More Salary and Got It

Does your work pay?

Not just day wages, but a good, round, stiff salary?

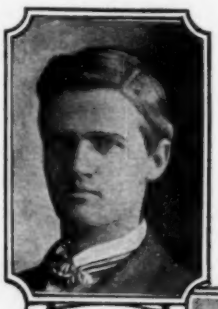
If not, why don't you make it pay?

You see men about you who earn dollars where you earn dimes, yet they work no harder than you.

What makes the difference? Luck?

Not often. What then?

In one word—**training.**



Wilson P. Hunt

To illustrate: Wilson P. Hunt, of Moline, Ill., was employed as a machinist's apprentice and was 20 years of age when he was, like you, endeavoring to work out the success proposition. He enrolled in the I. C. S. as the most practical means of doing this, and on finishing his Course he became draftsman, then a machine designer, and later started the Moline Tool Company, becoming Secretary and Superintendent of the concern. His earnings were, of course, very greatly increased.

FROM APPRENTICE TO PROPRIETOR

Another man who wanted more salary and got it by following out the definite I. C. S. plan is H. E. Mack, Board of Trade Building, Boston, Mass. Mr. Mack became an I. C. S. student when he was a shop hand in a telephone factory and was supplied with but very little schooling. Telling his experience in his own words, Mr. Mack says: "Your Course provided the knowledge that has enabled me to steadily advance to my present position as New England Manager for the firm of Pilling & Crane, Commission Merchants in iron, steel, coke, ores, and cement. When I began my Course my wages were about $6 per week. My earnings are now over five times as much and I have just refused an offer of $2,000 per year."

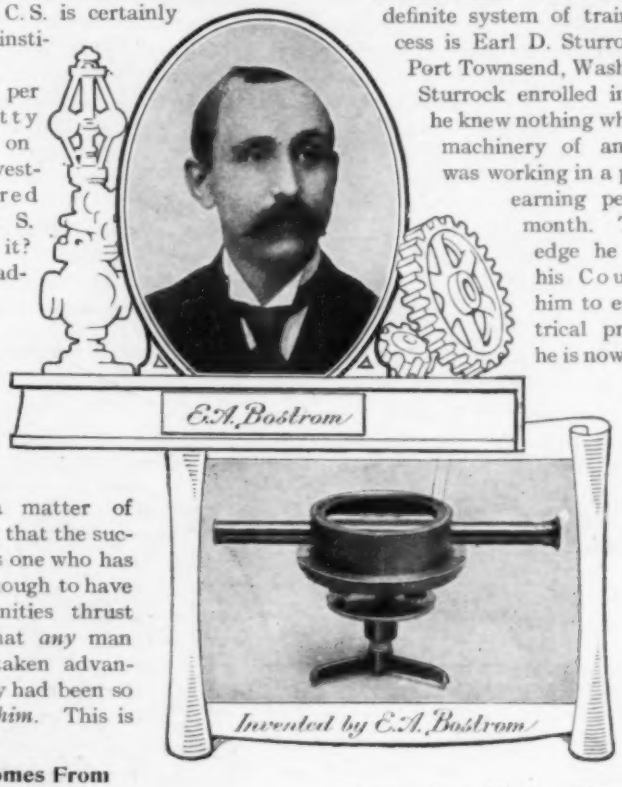
Just read the story of success that the I. C. S. has made possible for E. A. Bostrom, of Atlanta, Ga. Mr. Bostrom came to this country some years ago an unskilled Scandinavian. For some time he worked at various trades doing the best he could, but found advancement very slow on account of his lack of technical knowledge. When he heard of the International Correspondence Schools he saw his opportunity and decided to enroll at once. The training he received enabled him to steadily advance and secure a position as foreman and then superintendent of the machine shop in which he was working when he enrolled. He then invented a builder's level on which he secured three patents. He succeeded in interesting capital in his invention and resigned his position to become President of his own Company. Mr. Bostrom says: "We are now doing well and have sold several thousand instruments which have given perfect satisfaction. Your system is a blessing to the working people." Mr. Bostrom will certainly never regret the day he enrolled in the I. C. S., and there are thousands of others who can say the same. One of this number is G. A. Collins.

An Increase of 1,000 Per Cent.

How Mr. Collins made his work pay would read like romance if it were not an actual fact. Mr. Collins was a chainman with a Railroad Maintenance of Ways

Department at the time of enrolling with the I. C. S. After a few months he was promoted to rodman and then to transitman, but still he was dissatisfied; he wanted to lead instead of being led. Consequently he established an office of his own as Civil Engineer and became in addition Chief Engineer of a large coal company. Now, he says: "My earnings have been increased during this time nearly one thousand per cent., and I can recommend your institution to any ambitious, earnest man. The I. C. S. is certainly a wonderful institution."

A thousand per cent. is pretty fair return on the small investment required for an I. C. S. Course, isn't it? Mr. Collins' address is 717 N. Y. Block, Seattle, Wash.



Yet there are many men who believe that success is a matter of mere "luck," that the successful man is one who has been lucky enough to have fine opportunities thrust upon him that *any* man could have taken advantage of if they had been so thrust upon *him*. This is not true.

Success Comes From Definite Planning

The successful man of today is he who in the past prepared himself to seize opportunities as they presented themselves. Thus, the real "secret" of success lies in being prepared for it. A good instance of this lies in the experience of H. Gearing, 14 Leader Lane, Toronto, Ont.

Mr. Gearing states his case as follows: "I had always aimed for the position I now hold, and although I would likely have attained the same if I had not taken my Course it would be very much like a man walking to the top of a twenty-story building instead of taking the elevator." Mr. Gearing's Course enabled him to take advantage of his opportunities as fast as they came along, and his promotion was accordingly rapid. He enrolled when he was working as an elevator man. He is now one of the most competent mechanical experts of his city and recently refused an offer of $3,000 per year from a Chicago firm.

Another man who followed out a definite system of training for success is Earl D. Sturrock, Box 461, Port Townsend, Wash. When Mr. Sturrock enrolled in the I. C. S. he knew nothing whatever about machinery of any kind and was working in a printing office earning perhaps $30 a month. The knowledge he gained from his Course enabled him to enter the electrical profession, and he is now Proprietor of the Pacific Electric Company, with earnings reaching anywhere from $150 to $200 a month.

It is surprising to note the objections that some people raise to the I.C.S. system of training. This is especially remarkable when fair consideration shows it to be the most practical way in the world for promotion to better positions and earnings.

No Difficulties for the Truly Ambitious

Some say they have not the time or money, and others state that their previous education debars them from gaining any understanding at all of the study of such mathematical problems, etc. as are necessary to qualify them for the higher positions in the

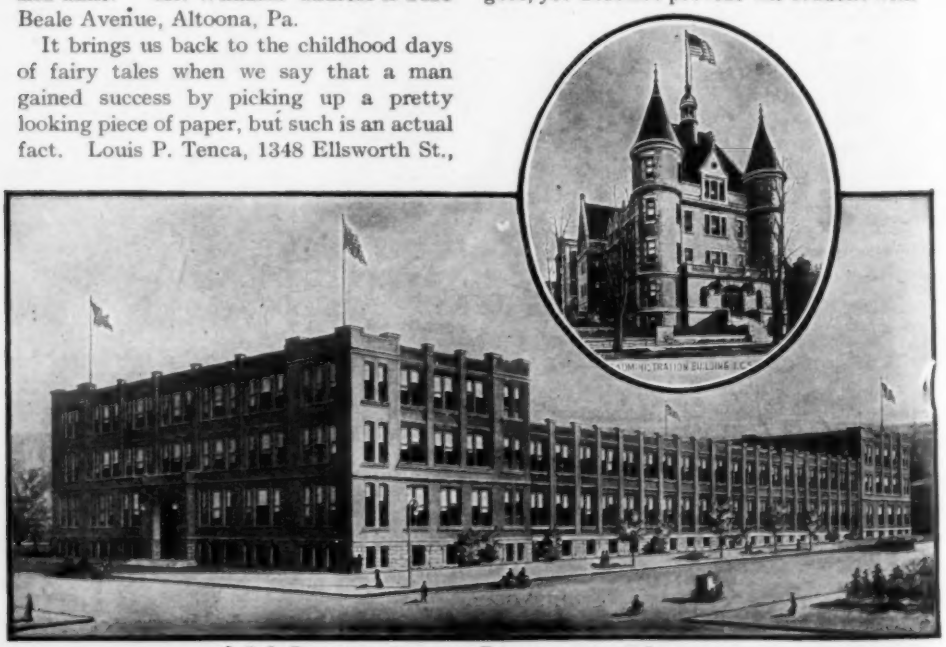
technical fields. But these very persons are generally those that have far fewer difficulties to overcome than hundreds who have successfully pursued I. C. S. Courses.

For instance, take the case of Joseph Williams. Mr. Williams was put to work in the mines when he was 10 years old and in all he had about 6 months' schooling, so you see he could not possibly have had much of an education to enable him to understand mathematical problems in mining engineering. At the time he enrolled he had a family to support on earnings of less than $50 a month, so again we have not much trouble in realizing that he had no money to spare; and as for time, his hard labor in the mines often lasted long over the regular working hours. But all this did not phase Mr. Williams, he had the sincere ambition to better himself, so he became an I. C. S. student and faithfully pursued his studies until they brought him the reward of a position as Mine Inspector for the Tenth Bituminous District of Pennsylvania, at a salary of $3,000 per year. Mr. Williams says: "It would have been impossible for me to secure my present success had I not enrolled in your Schools. I shall never grow tired of praising the I. C. S. for what they have done for me and mine." Mr. Williams' address is 2425 Beale Avenue, Altoona, Pa.

It brings us back to the childhood days of fairy tales when we say that a man gained success by picking up a pretty looking piece of paper, but such is an actual fact. Louis P. Tenca, 1348 Ellsworth St., Philadelphia, Pa., was a mechanic employed at the Baldwin Locomotive Works. He had but recently come to this country and could not read, write, or speak English. One night when going home from work he noticed a piece of paper lying on the street which attracted his attention. He picked it up and carried it to the pastor of his church and asked him to translate the reading matter to him. It happened to be an I. C. S. Circular, and as a result of his curiosity Mr. Tenca decided to enroll. In studying his Course he was obliged to read three books instead of one, a grammar, a dictionary in two languages, and an I. C. S. Textbook. He was obliged to translate his Instruction Papers into his own language before he could study them, and then translate his answers into English. But with perseverance and the never tiring assistance of I. C. S. instructors he gained the technical knowledge which enabled him to advance to a position as locomotive erector for the Baldwin Works and to secure a large increase in earnings.

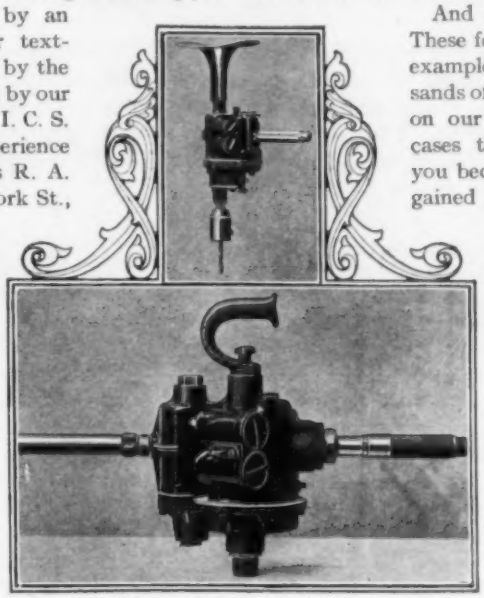
Practical Success

There are also some people who believe that the instruction afforded by the I. C. S., however excellent it may be as far as it goes, yet does not provide the student with



I. C. S. Buildings Occupied Entirely by the Schools

a thorough, complete, and detailed knowledge of the profession he wishes to follow out. That this is a wrong idea may be readily ascertained by an examination of our textbooks and is proved by the results accomplished by our students. One I. C. S. student whose experience nullifies this idea is R. A. Norling, 489 New York St., Aurora, Ill. Mr. Norling enrolled in his I. C. S. Course when he was employed as an inspector at the Elgin Watch Factory. The excellence and thoroughness of the instruction contained in the Mechanical Course in which he enrolled provided a knowledge that has enabled him to become an inventor of many intricate machine appliances and he is now mechanical engineer and tool designer for the Aurora Automatic Machine Company, of Aurora, Ill., and has full charge of the patternmaking, experimental room, and drafting room of this concern. His earnings have increased 250 per cent. and the royalties received from his twelve patents make this amount a good deal more. Mr. Norling says of the I. C. S.: "I feel that my own experience warrants me in recommending the I. C. S. to any ambitious man who wishes to advance in his trade."



WOOD-BORING MACHINES
Invented by Student R. A. Norling

Just to show that the I. C. S. is one of the most powerful influences toward advancement-gaining in the world, let us relate the experience of Eugene Popper, 544 Clark St., Chicago. Mr. Popper applied for a position to Ernest F. Smith, superintendent substations, Chicago Edison Company. In giving Mr. Popper the place, his employer said: "I had 200 applicants for this position, but I am going to give it to you because you have such a good reference." In commenting on this, Mr. Popper writes: "My reference was an I. C. S. letter of recommendation, and that was all. Now you can see what the largest concerns in the United States think of the I. C. S."

And so the story runs. These few cases are merely examples taken from thousands of others that we have on our files—thousands of cases that would astound you because the men have gained advancement so quickly and so easily. Yet it is all plainly understood when you consider that a six-million dollar institution has spent 16 years in constantly perfecting a system of education that will qualify ambitious men and women of small means to gain promotion to the highest places in their trades and professions.

How **you** can gain advancement in this way; how you can qualify in your spare time, in your own home, and at an insignificant cost for a better position and a better salary will be explained, free of charge, if you are interested enough in your future welfare to clip, mark, and mail the coupon below. **Will you let a postage stamp prevent your winning a better position?**

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 872, Scranton, Pa.

Please explain, without further obligation on my part, how I can qualify for a larger salary and advancement to the position before which I have marked X

Bookkeeper	Mechanical Draftsman
Stenographer	Telephone Engineer
Advertisement Writer	Elec.-Lighting Supt.
Show-Card Writer	Mechanical Engineer
Window Trimmer	Surveyor
Commercial Law	Stationary Engineer
Plumb. & Heat. Con't.	Civil Engineer
Illustrator	Building Contractor
Civil Service	Architect'r'l Draftsman
Chemist	Architect
Textile Mill Supt.	Structural Engineer
Electrician	Bridge Engineer
Elec. Engineer	Mining Engineer

Name _____

Street and No. _____

City _____ *State* _____

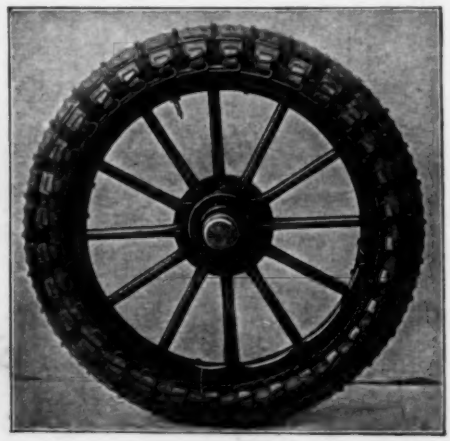
AN ELECTRIC HOME

In Which Motors, Wires and Lights Solve the Servant Problem and Do Other Marvelous Things

Various ingenious electrical appliances which almost completely eliminate the necessity of personal servants and make life a "dream" have been installed in a house in France, considered one of the most wonderful in the world from a mechanical standpoint. Not quite satisfied, however, the owner, who is also the inventor of many of the appliances, is drawing plans for a house which he believes will be the model home of the future.

In the house now occupied are not only devices invented and in use by other people, but new ones invented as the necessity presented itself. The gate of the villa is controlled by a motor from the house. By means of telephone, searchlight, and a series of mirrors, anyone within the house can converse with, and examine persons seeking admission. An electric oven, equipped with an automatic indicator which gives warning when the dish is fully baked, insures a well served meal for the guest ushered in on the wings of Benjamin Franklin's discovery. A small dumb-waiter and table railway deposits the meal at its appointed place on the table; foot-warmers under the table, heaters around the room, and well arranged electric lights add to the excellence of the service. By an automatic ventilating system fresh, perfumed air is introduced when the temperature of the room rises to a certain point. Other rooms as well fitted eliminate servants as much as possible.

All this, however, is but little compared to the marvelous things electricity will be called upon to accomplish in the new house soon to be constructed, all of which can be carried out successfully. Not satisfied with controlling the temperature of the house only in winter time, the building will be constructed with double walls, separated by a space 2 ft. wide, through which cool air will be circulated during the summer. This space will also be utilized for pipes, wiring, and a dumb-waiter system which will serve persons in any room in the house. Each room will be fitted up so that a touch of a button will raise or lower shades, open or close shutters, control the temperature, bring refreshments from pantry and the mail and papers from the porch: Without, mind you, even a whispered order.



Armor Attached to Tire

ARMOR AS AUTO TIRE PROTECTOR

Automobilists are greatly interested in a new steel armor device for the protection of pneumatic tires. The armor is made in sections consisting of rings to which small links are attached, and top plates to which the two side plates are fastened. The tire is covered by hooking the three piece part to the small links. The top plate is a center hinge with corrugations on the face. The rings have loops, with a trifle over 2-in. draw, so that when the tires are inflated the ring spreads, spacing the plates and holding them firmly in position.